

Implications of Climate Change for the Insurance Industry: *Risk or Opportunity?*

Presented at Roundtable on:
Facing the Consequences of Climate Change in San Juan, Puerto Rico

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University of California

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May 8, 2007

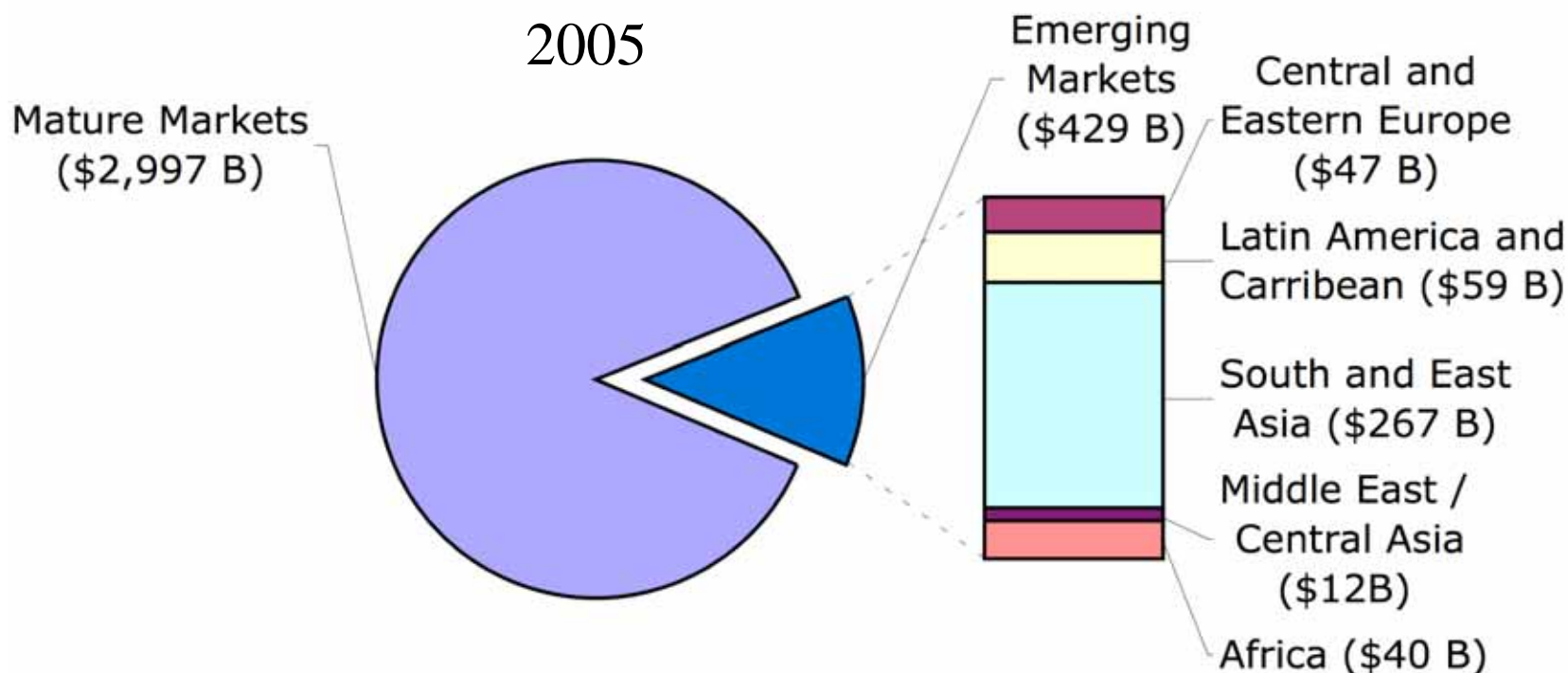


**Climate variability is a fact of life;
but the dice are loaded**



\$3.4 *Trillion* World Insurance Market

- World's biggest industry; important to economic development
- Large employer
- Major player in financial markets
- Enormous political influence

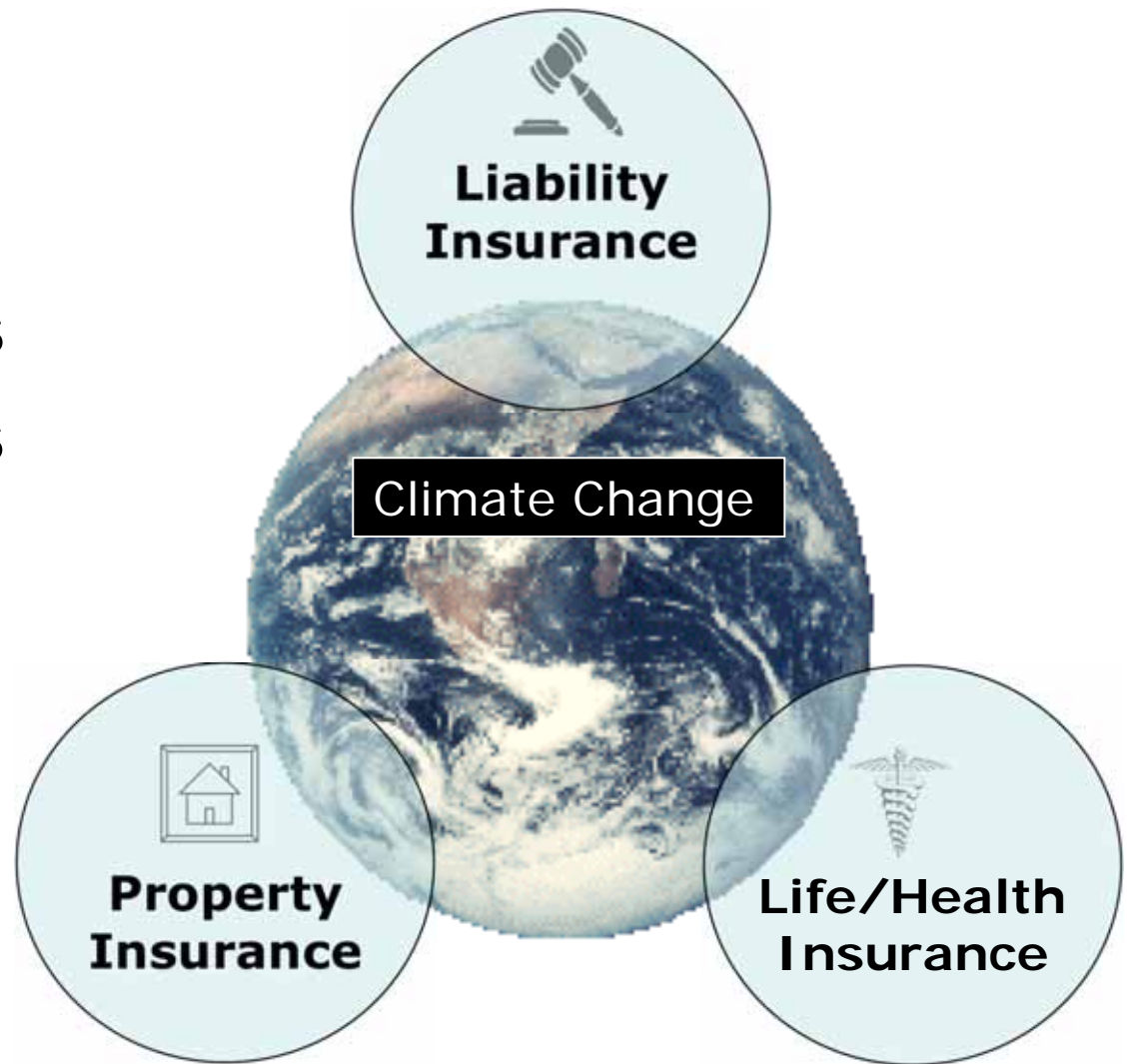


Source: Swiss Re, Sigma No. 5/2005

Climate Change: Intersection with Insurance

Insurers are....

- integrators
- risk spreaders
- risk managers
- vulnerable
- selective
- potential part of solution



Insurance-relevant Consequences



Property Insurance

- Property damage
- Mold/moisture
- Forest products
- Agricultural products
- Business interruption
- Roadway



Life/Health Insurance

- Injury
- Infectious disease
- Heat stress
- Respiratory
- Pollutant releases
- Food poisoning
- Mental health
- Nutrition/water



Liability Insurance

- General
- Product
- Environmental
- Professional
- Political Risk
- Roadway

Insurance Industry is Concerned

“We'd be out of our minds if we wrote weather insurance on the opinion global warming would have no effect at all.”

- Warren Buffett
2006 annual Shareholder meeting

Insurance Regulators (via NAIC) are Concerned

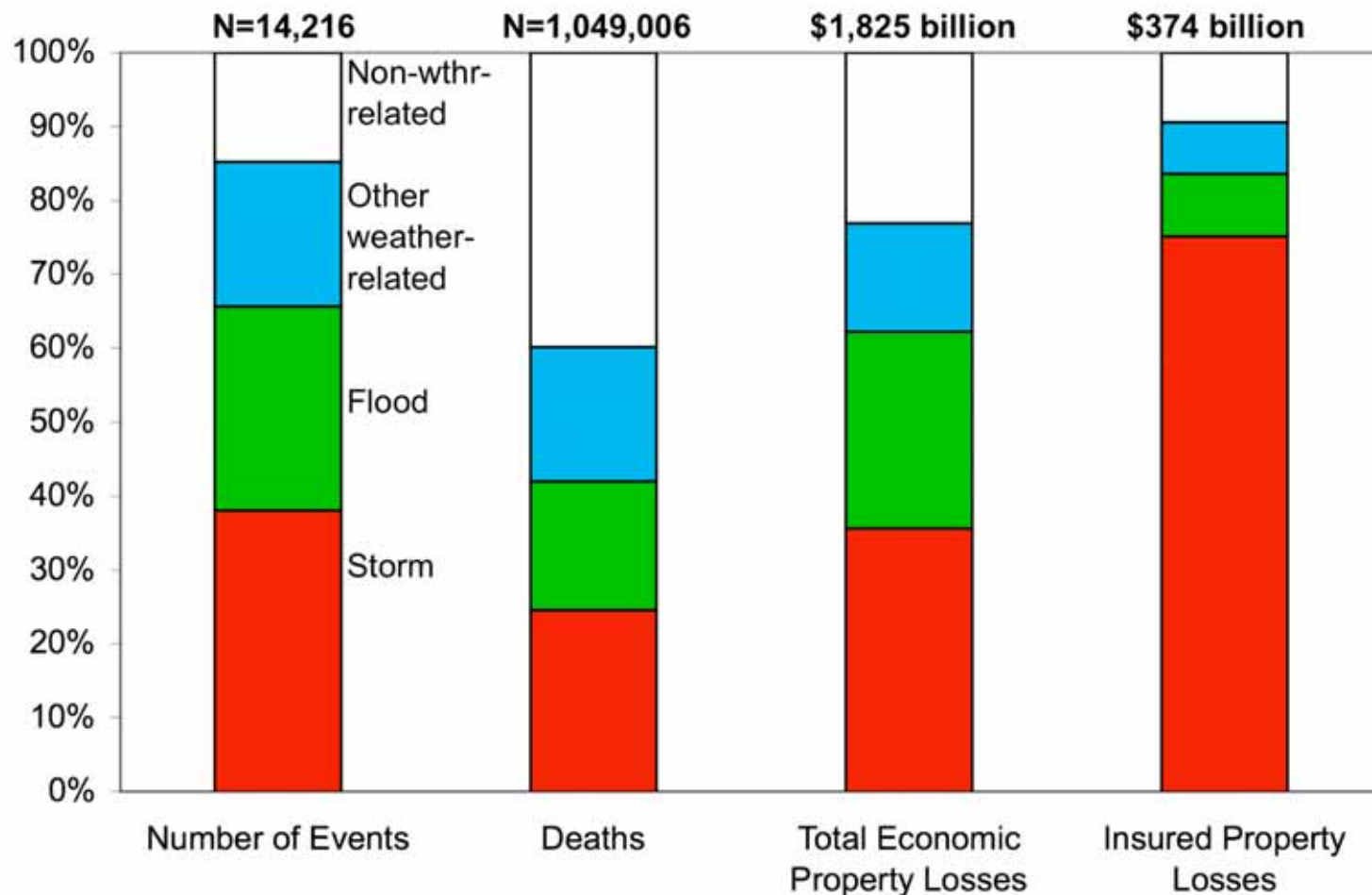
“Global warming is upon us, and it poses unprecedented new threats to the insurance industry and vast segments of society that rely on insurance for peace of mind and financial security.”

- Michael Kreidler
Washington Insurance Commissioner

- Tim Wagner
Nebraska Insurance Commissioner

Disasters Look Different Through an Insurance “Lens”

Aggregate Global Impacts: 1980-2004

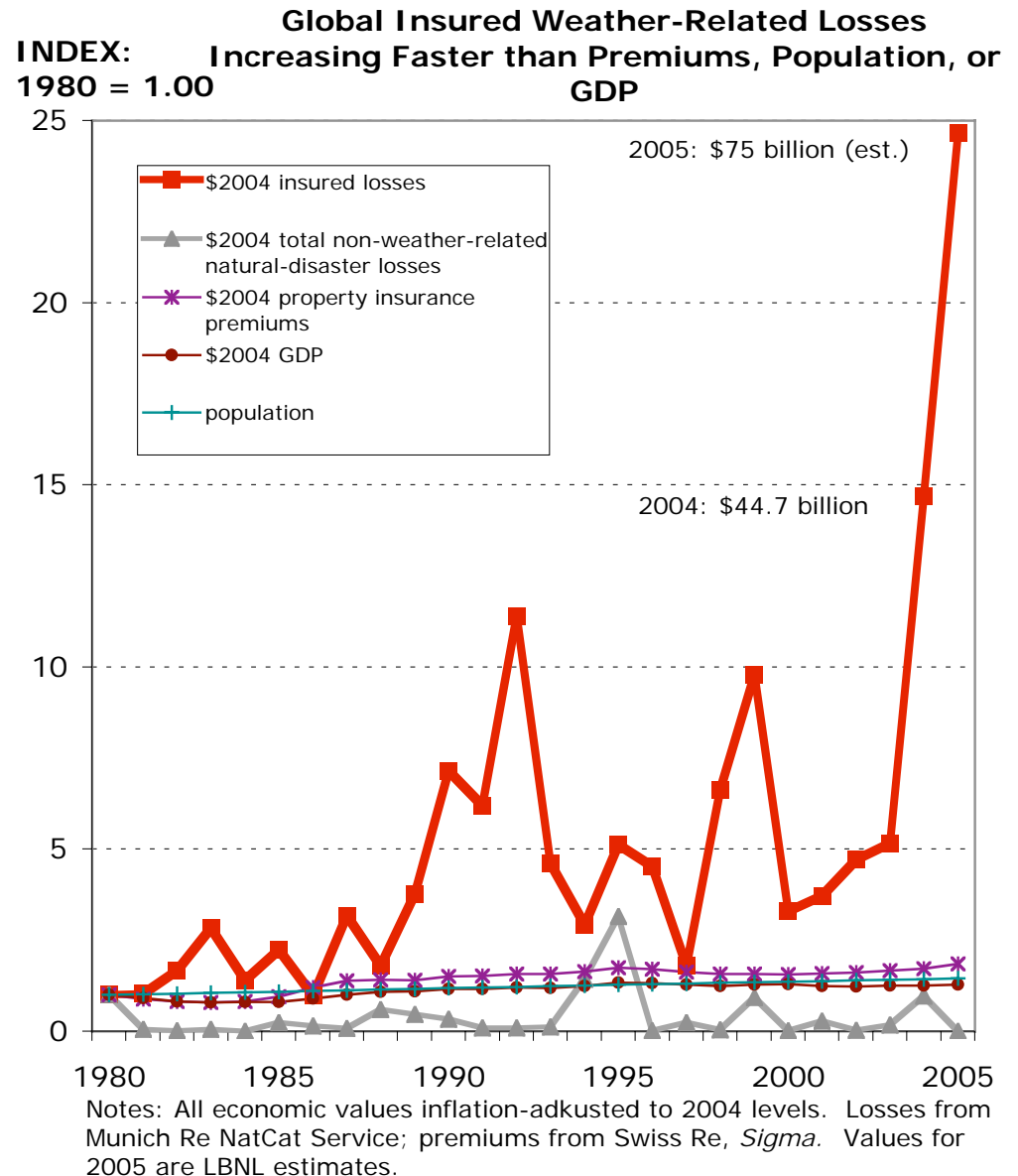


E. Mills Science 309, 1040 -1044 (2005)

Uncertainty: Physical Financial

Non-climate factors play a role, but...

- Trends *consistent* with observed change
- Why are non-weather losses level?
- Even worse without prevention efforts



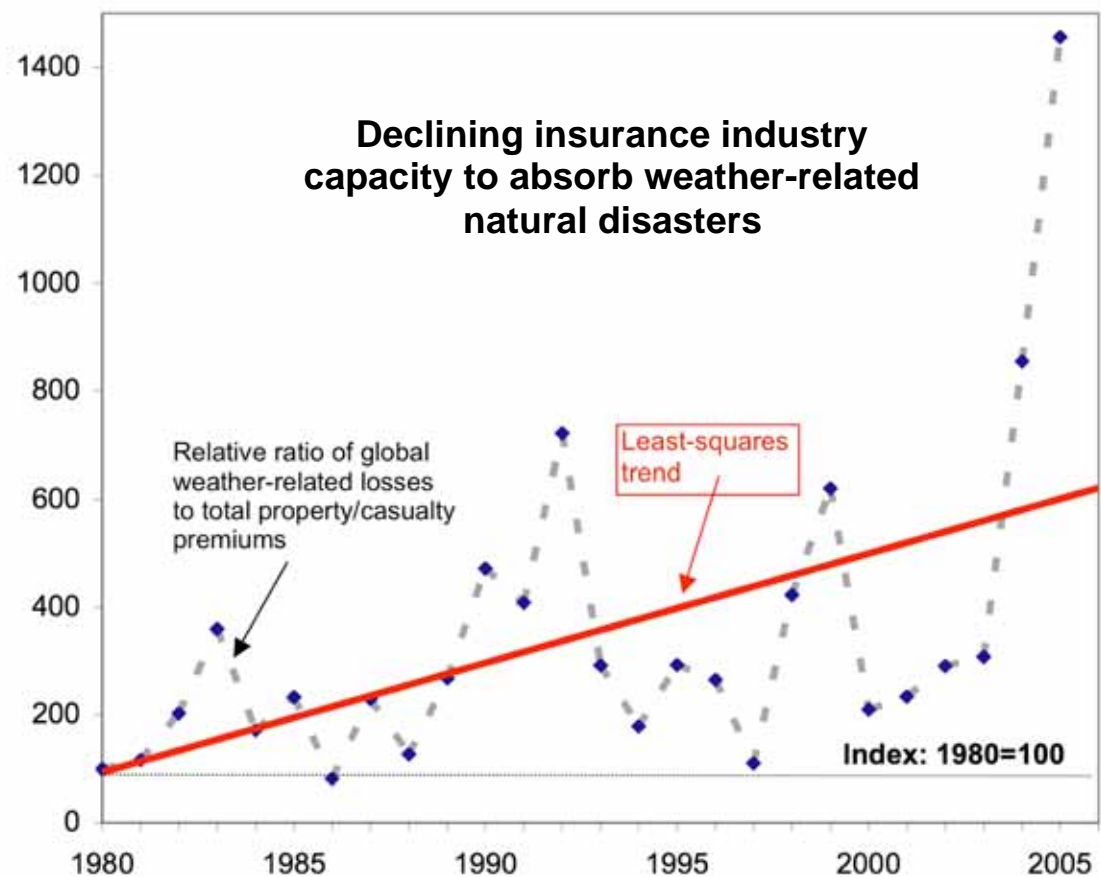
Risk is OK

Volatility & Uncertainty is Not

The ratio of losses to premium revenues is increasing

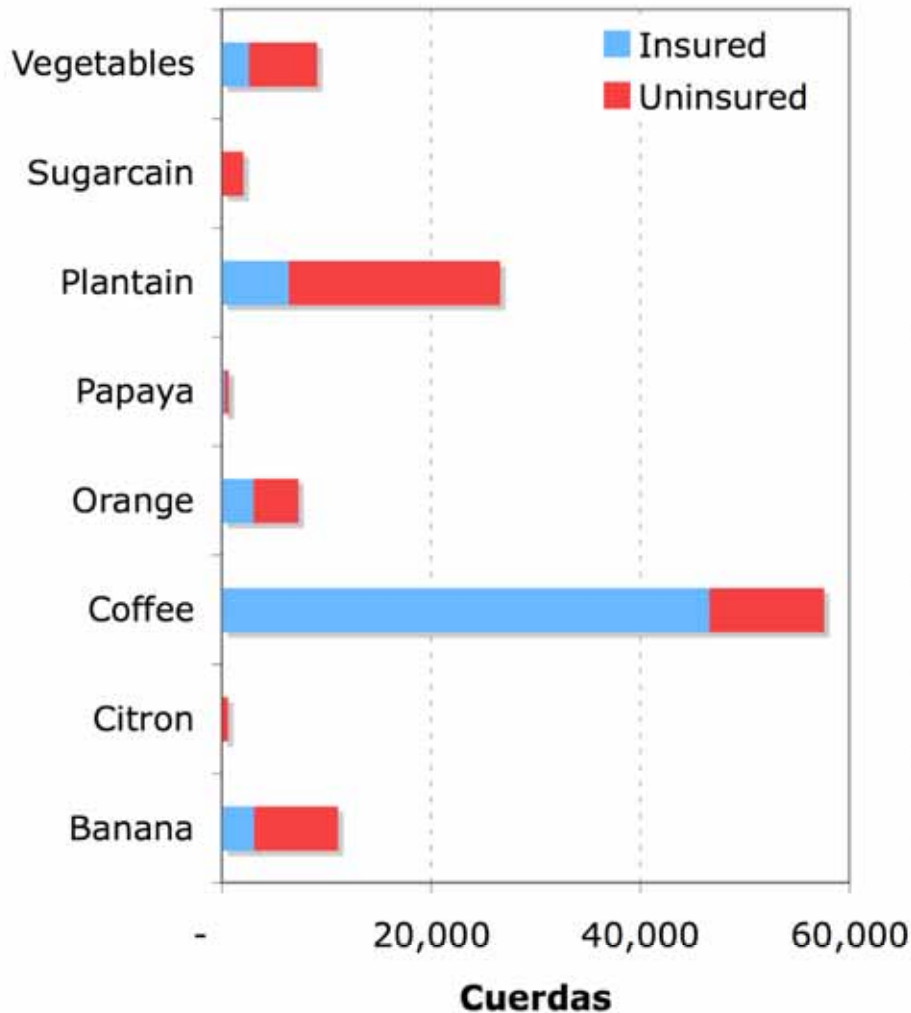
Unknowns:

- Underwriting
- Competition
- Operations
- Investments
- Shareholders
- Reputation
- Regulation
- *Insurability*

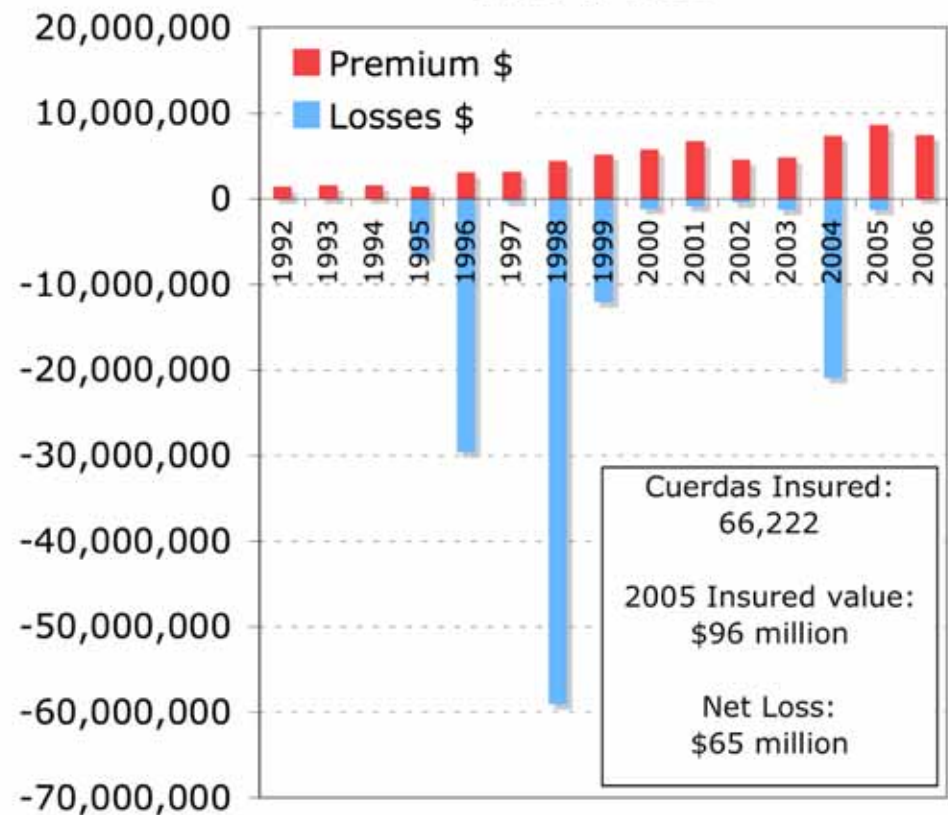


Crop Insurance in Puerto Rico

**Crop Insurance in Puerto Rico:
2006**

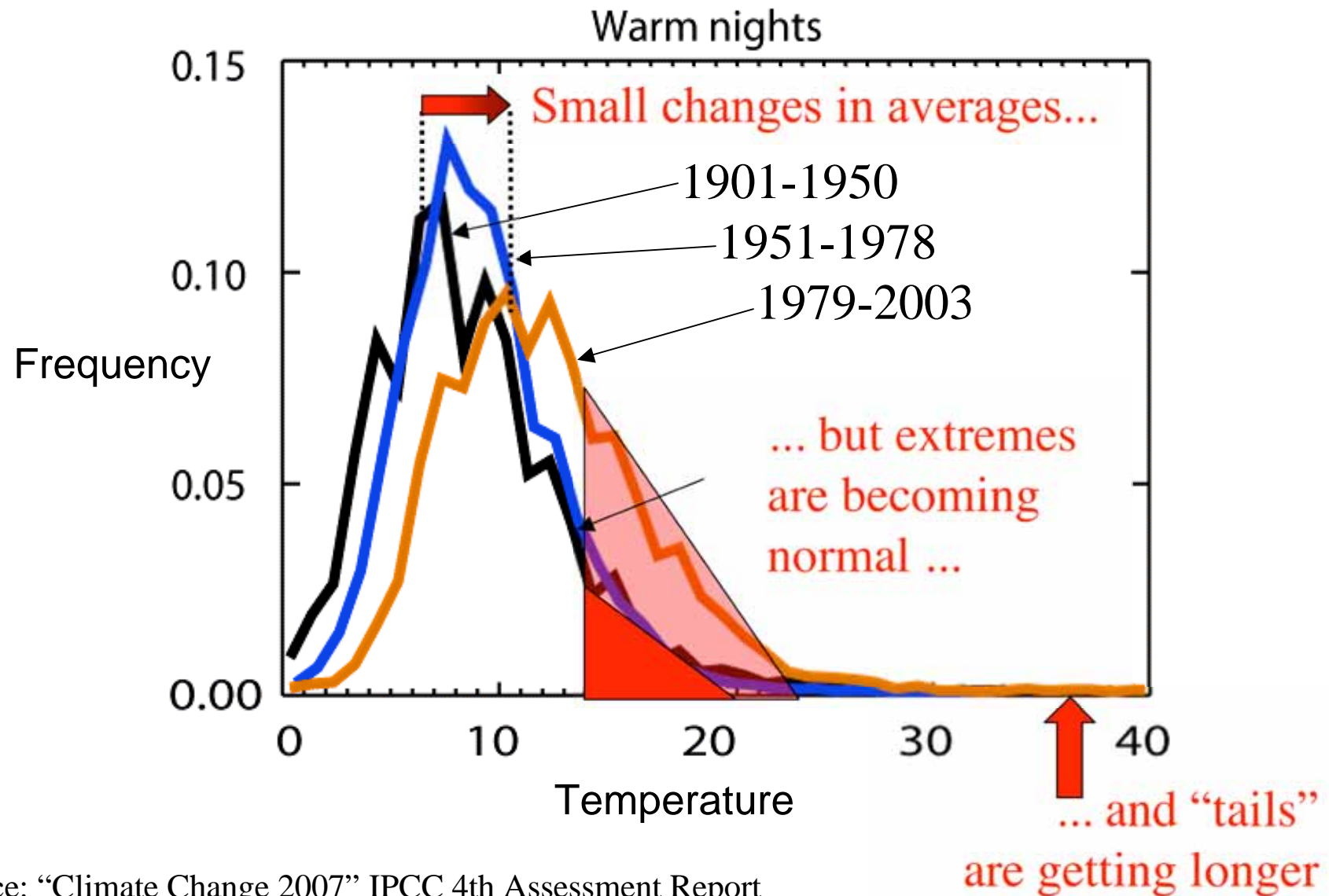


**Government Crop Insurance and
Losses in Puerto Rico
1992-2006**



Source: Puerto Rico Crop Insurance
Profile, US Risk Management Agency

Extremes Shift *More* Than Avg's.

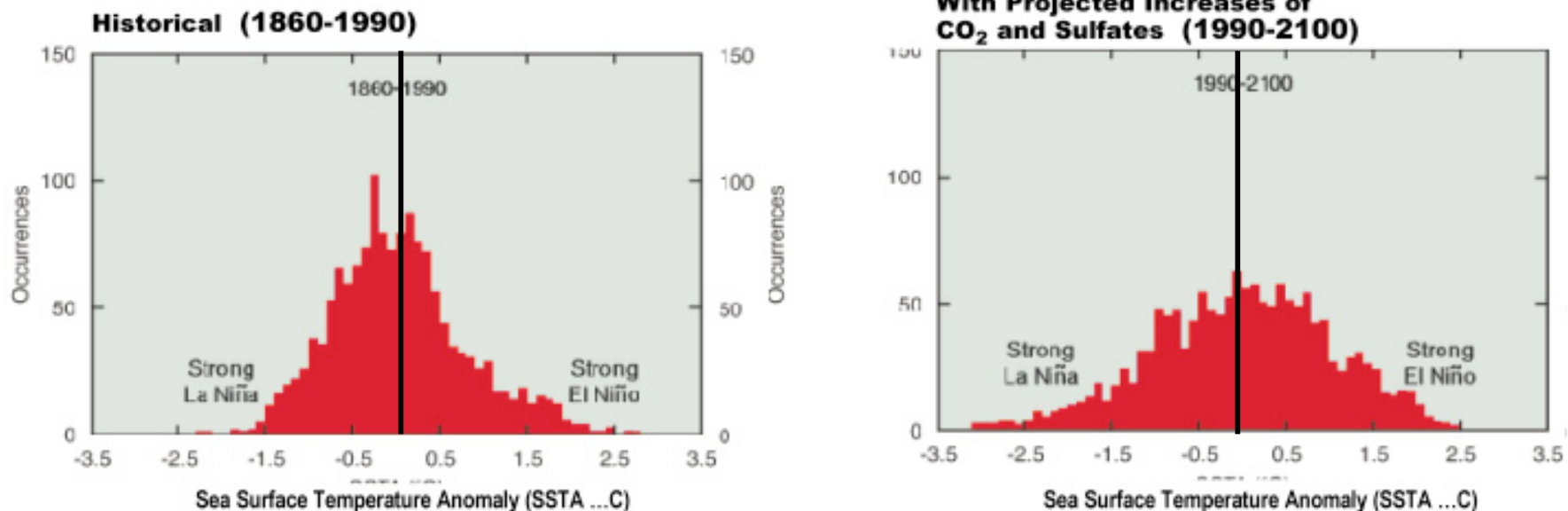


Source: "Climate Change 2007" IPCC 4th Assessment Report

Implications for ENSO

Current and Projected SST Anomalies in Equatorial Pacific

El Niños and La Niñas Observed and Projected Sea Surface Temperature Anomalies

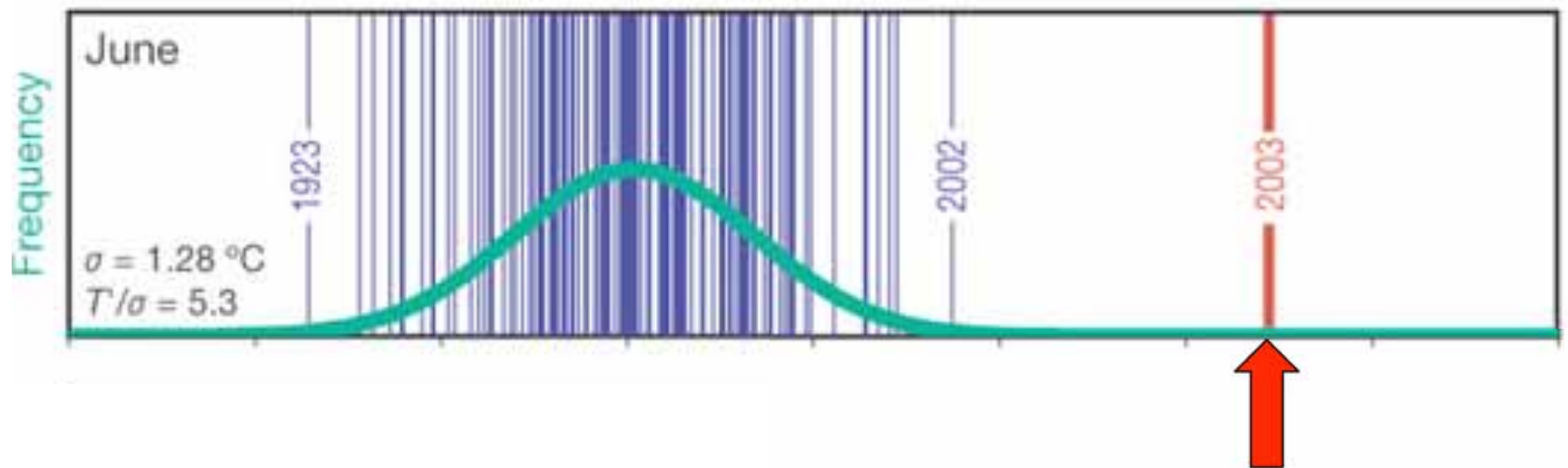


Some model projections suggest more frequent El Niño-like conditions and stronger La Niñas as a result of climate change. Sea surface temperature (SST) deviations from normal in the equatorial Pacific are used to measure the strength of El Niños and La Niñas. These high resolution model projections by the Max Planck Institute suggest more SST deviations from normal and thus more frequent El Niños and stronger La Niñas in the future. The high bars in the center are occurrences of normal SSTs. In the projections in the right hand graph, these normal temperatures occur less frequently, while lower (La Niña) and higher (El Niño) SSTs occur more frequently. The Max Planck model is used here because it has been able to reproduce the strength of these events better than other models due to its physics and ability to resolve fine scale structure in the ocean.

Source: *Climate Change Impacts on the United States. "The Potential Consequences of Climate Variability and Change Overview: Islands in the Caribbean and the Pacific."* By the National Assessment Synthesis Team, US Global Change Research Program
Published in 2000

Rare Extremes Cause Most of the Damages & Insured Losses

The European heat wave of Summer 2003

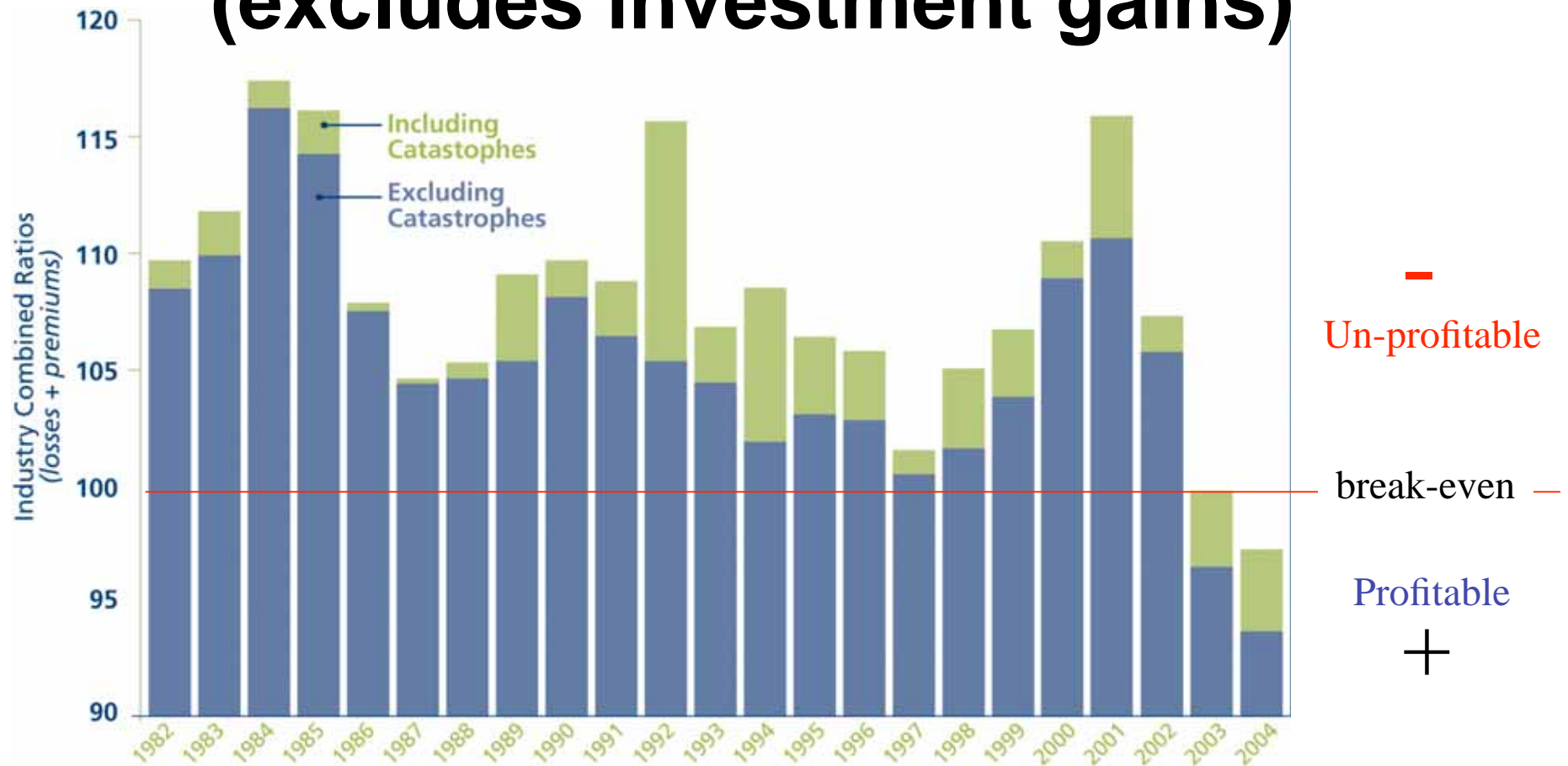


Event was “six-sigmas” outside of norm.
16°F above average in France and Germany
was a 1-in-10,000 event to 1-in-46,000 event

Source: Schar et al, *Nature*, v. 427, 2004.

“CATs” Play Role in Profitability

P&C Combined Ratios: 1982-2004 (excludes investment gains)



Note: Catastrophes are not the only climate change impact of concern

Source: AM Best, Aggregates & Averages

Small-scale, Indirect Events and Consequences Often Overlooked

Greater combined impacts than CATs in an average year

Events

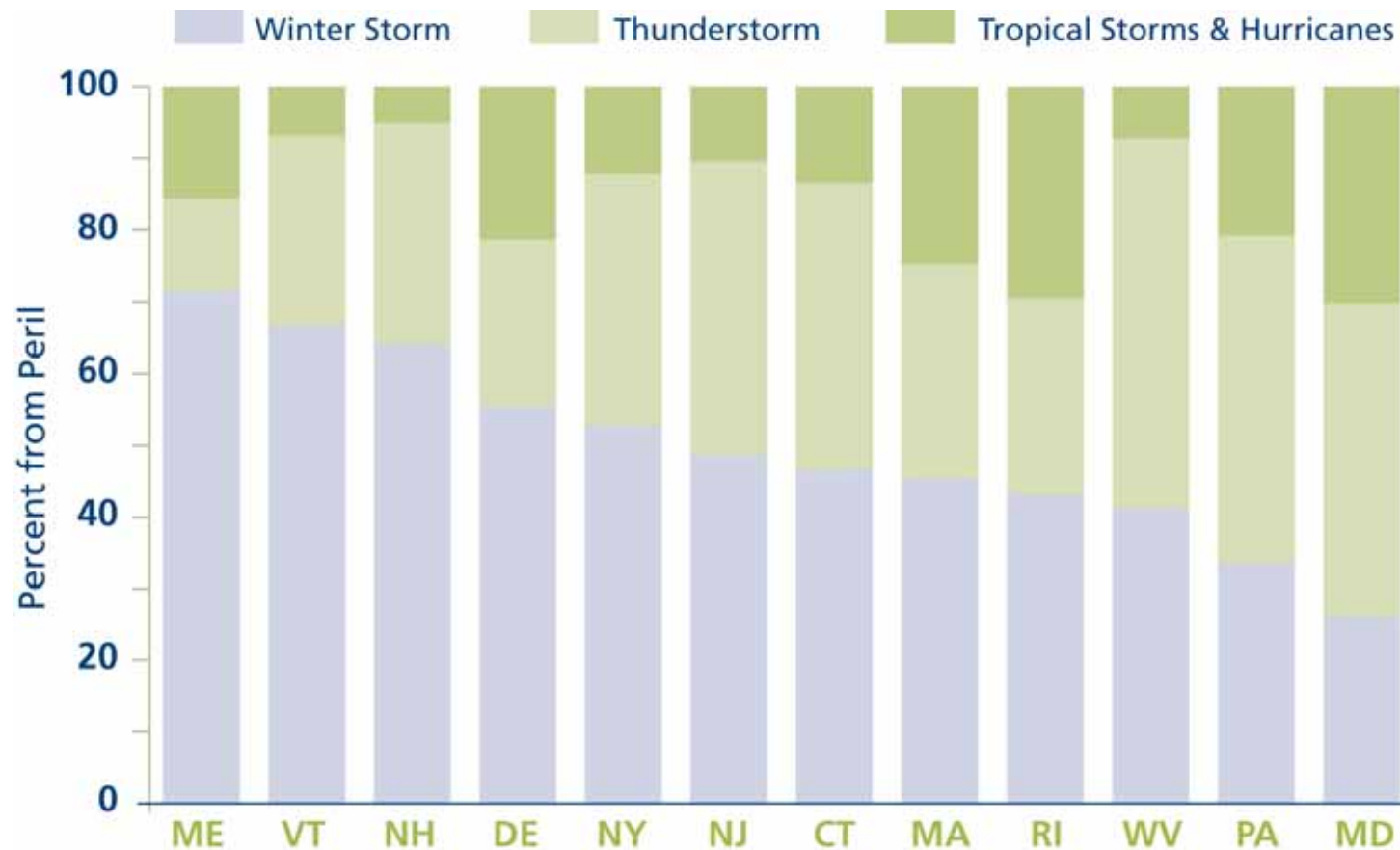
- Drought
- Hail
- Heat waves
- Ice Storms
- Lightning
- Sea-level rise
- Thunderstorms
- Tornadoes
- Torrential rains
- Wildfire
- Winterstorms

Consequences

- Blackouts
- Coastal erosion
- Crop/fishery damages
- Equipment breakdown
- Eroded air quality
- Eroded water quality
- Flooding
- Health impacts
- Mudslides
- Property loss
- Sinkholes/Subsidence
- Weather-related vehicle accidents



Importance of Small-Scale Events



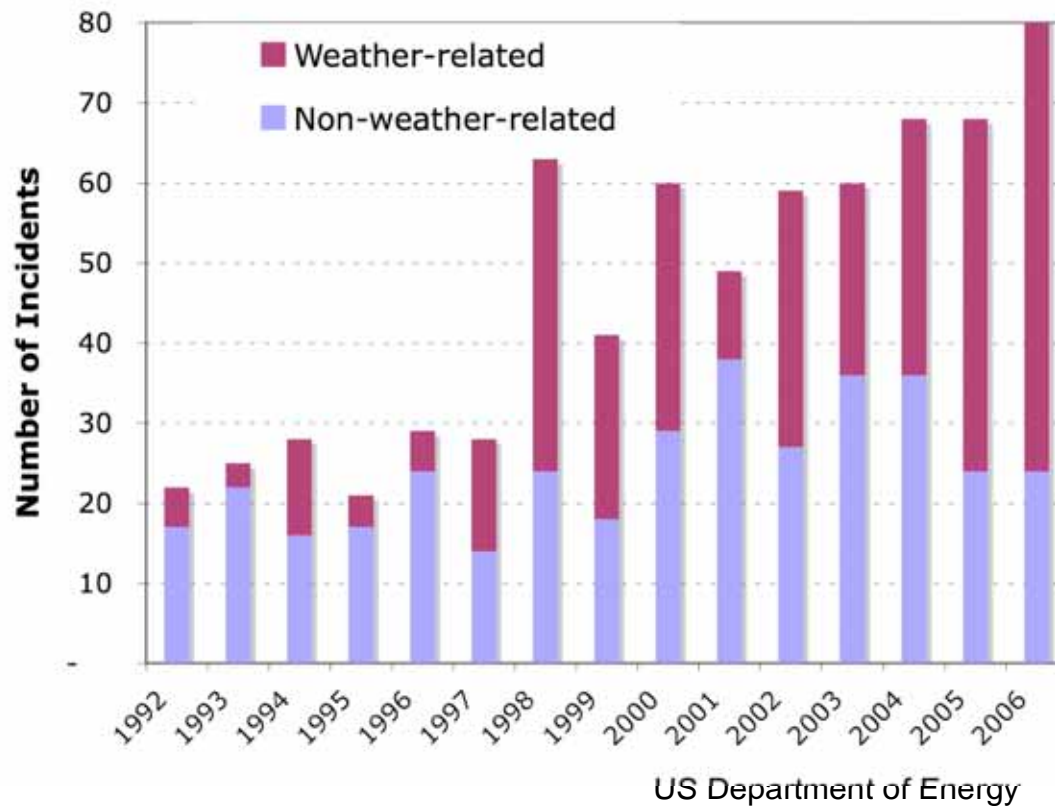
Source: American Re (2005) -- data for 1980-2004

Mudslide in El Salvador (2001)



U.S. Power Outages

US Electric Grid Disturbances (1992-2006)
Weather- and Non-Weather-Related
110 million customers effected



U.S. total cost: ~\$80B/year

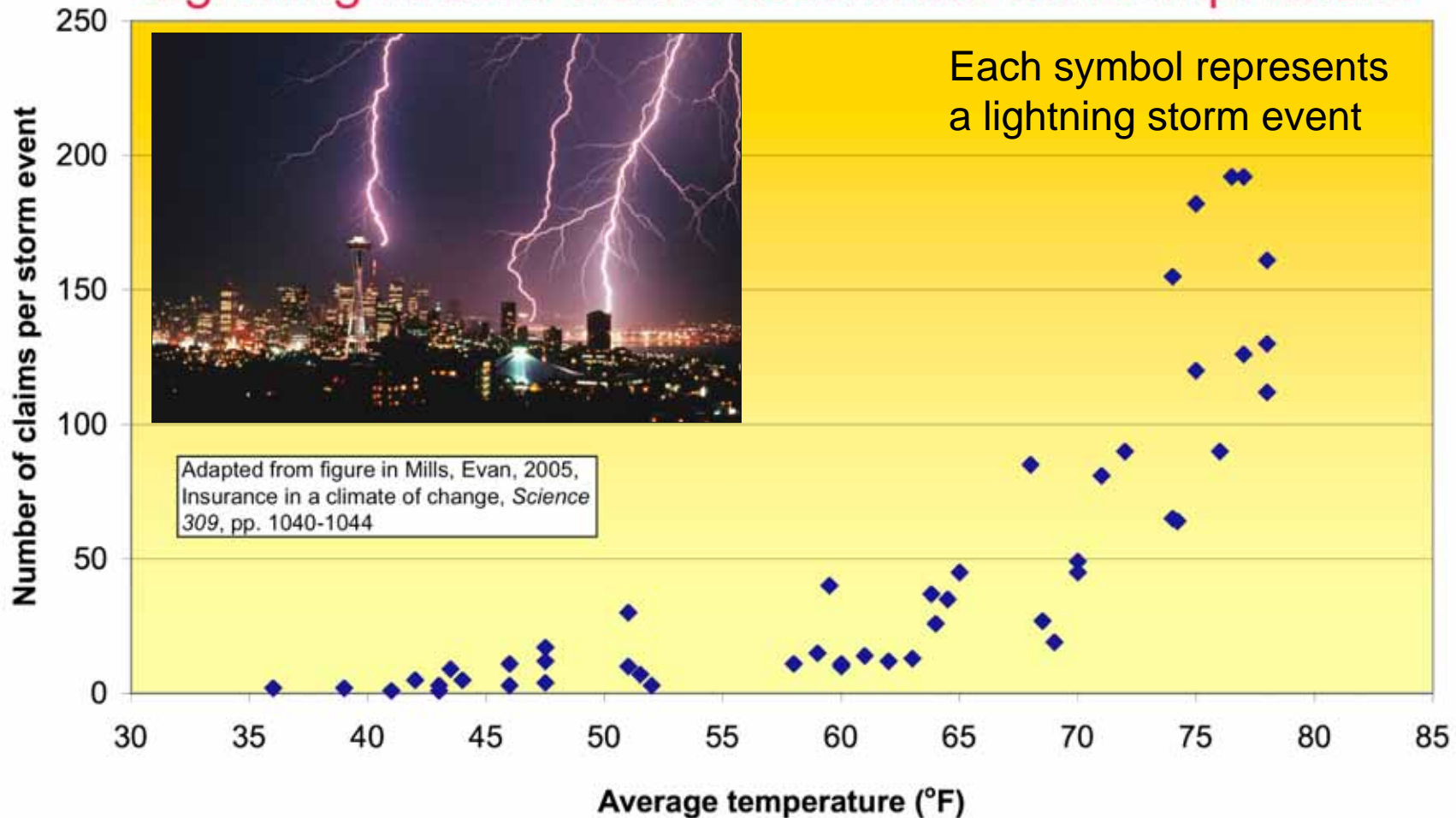
*Current insured portion unknown:
most are below ISO/PCS threshold
for being “worth” counting*

RMS Scenario: \$2.7B for NY

Power outages were a factor in slowness of draining New Orleans following Hurricane Katrina. Also important for business interruption.

Temperature-Related Insurance Loss Experience

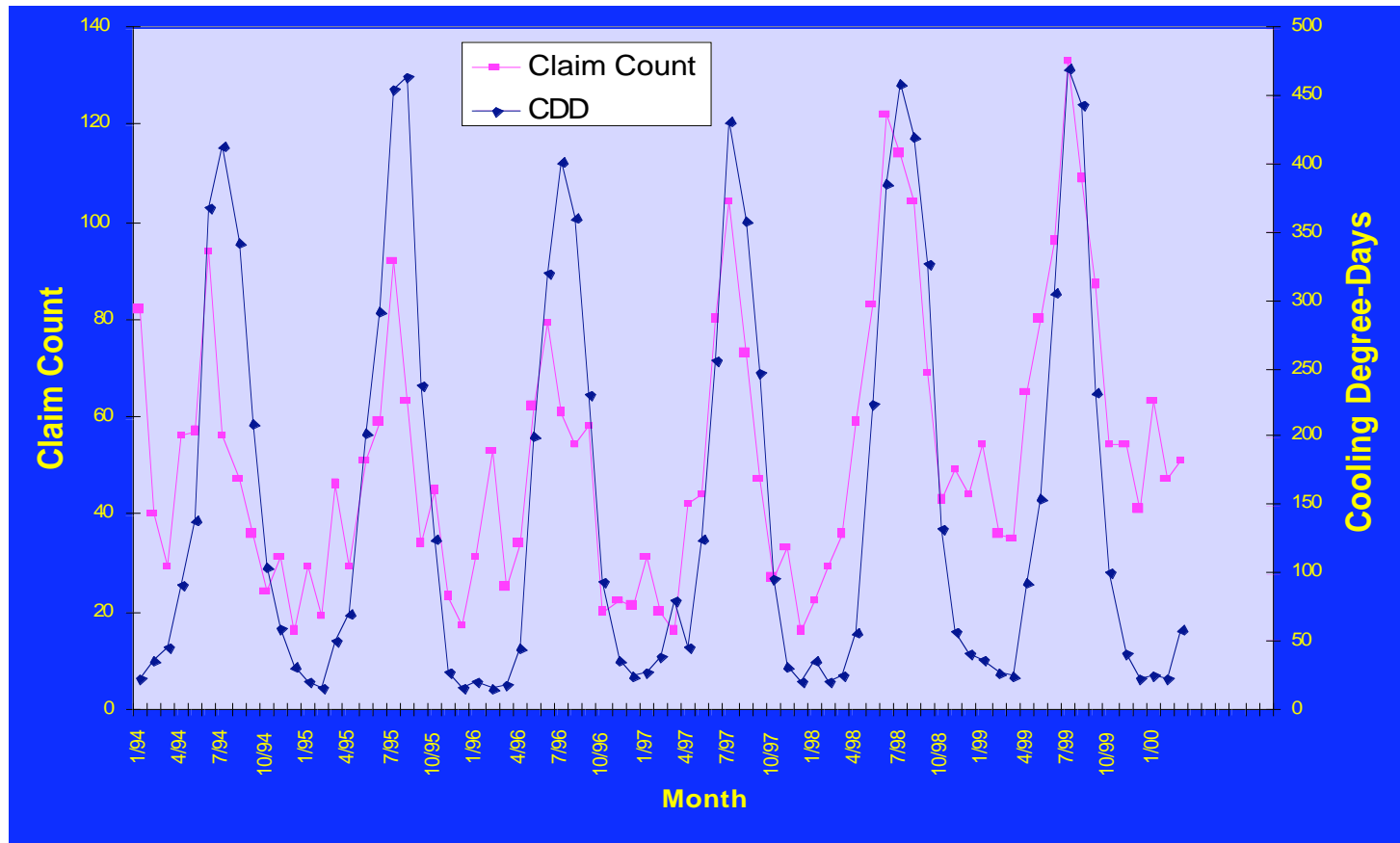
Lightning-related claims *accelerate* with temperature



Source: Hartford Steam Boiler Inspection and Insurance Co.

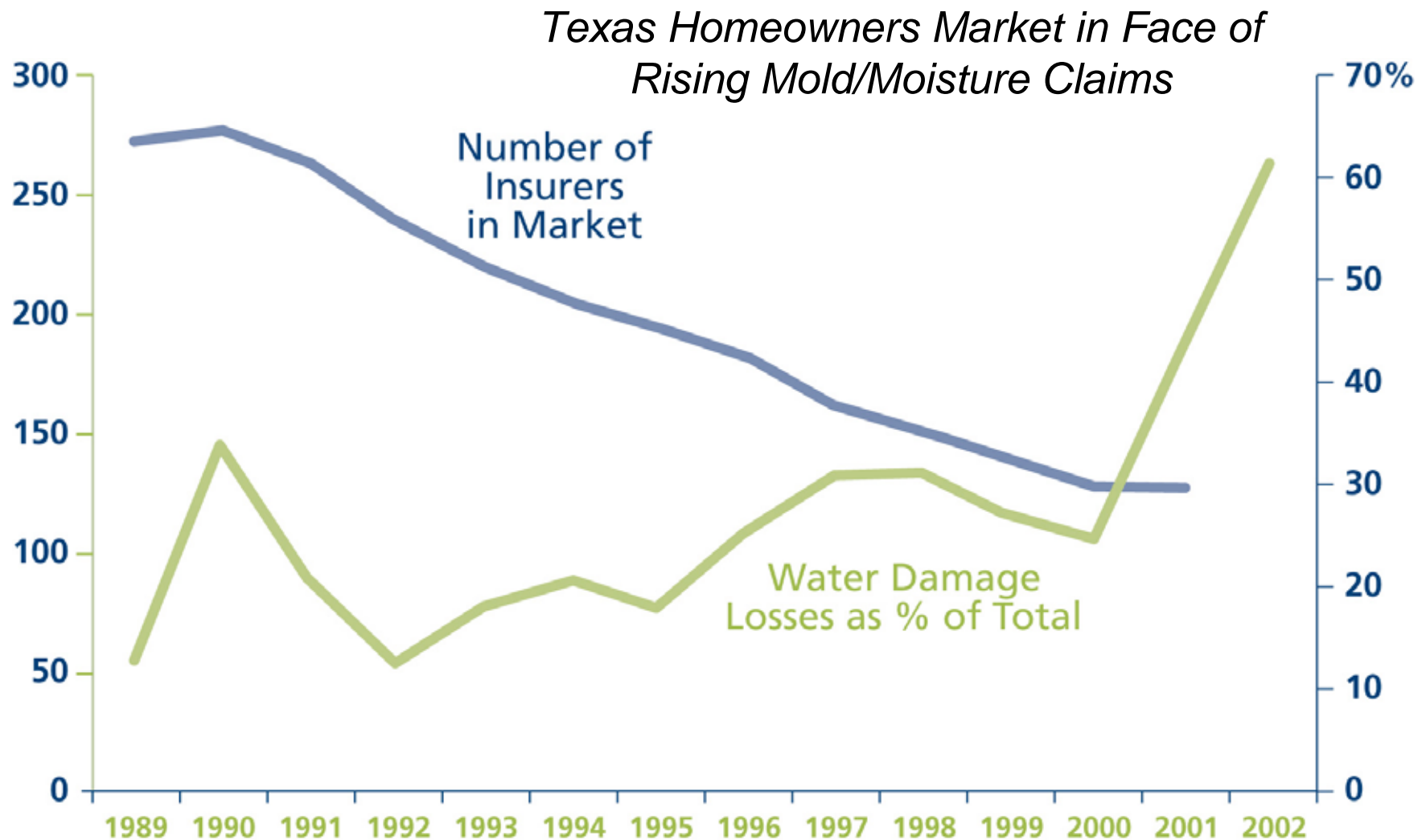
Temperature-Related Insurance Loss Experience

Air-conditioning breakdown claims increase with cooling degree days: 1994-1999



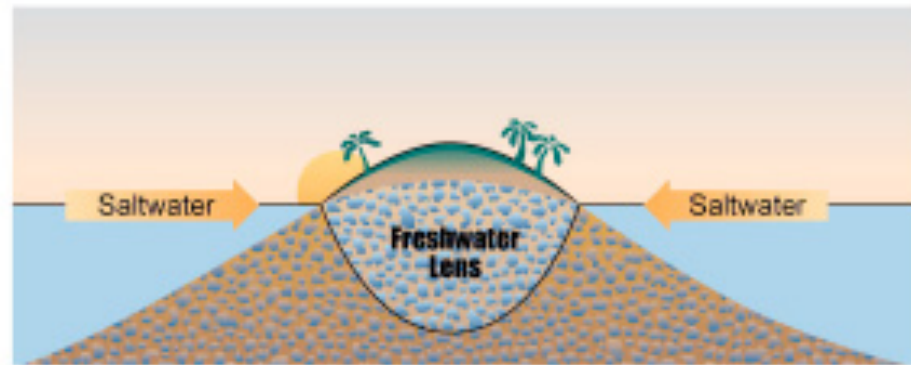
Source: Hartford Steam Boiler Inspection and Insurance Co, 2001

Mold & Moisture Damages



Water Quality

Freshwater Lens Effect in Island Hydrology



Water Quality

CALIFORNIA
www.50states.com

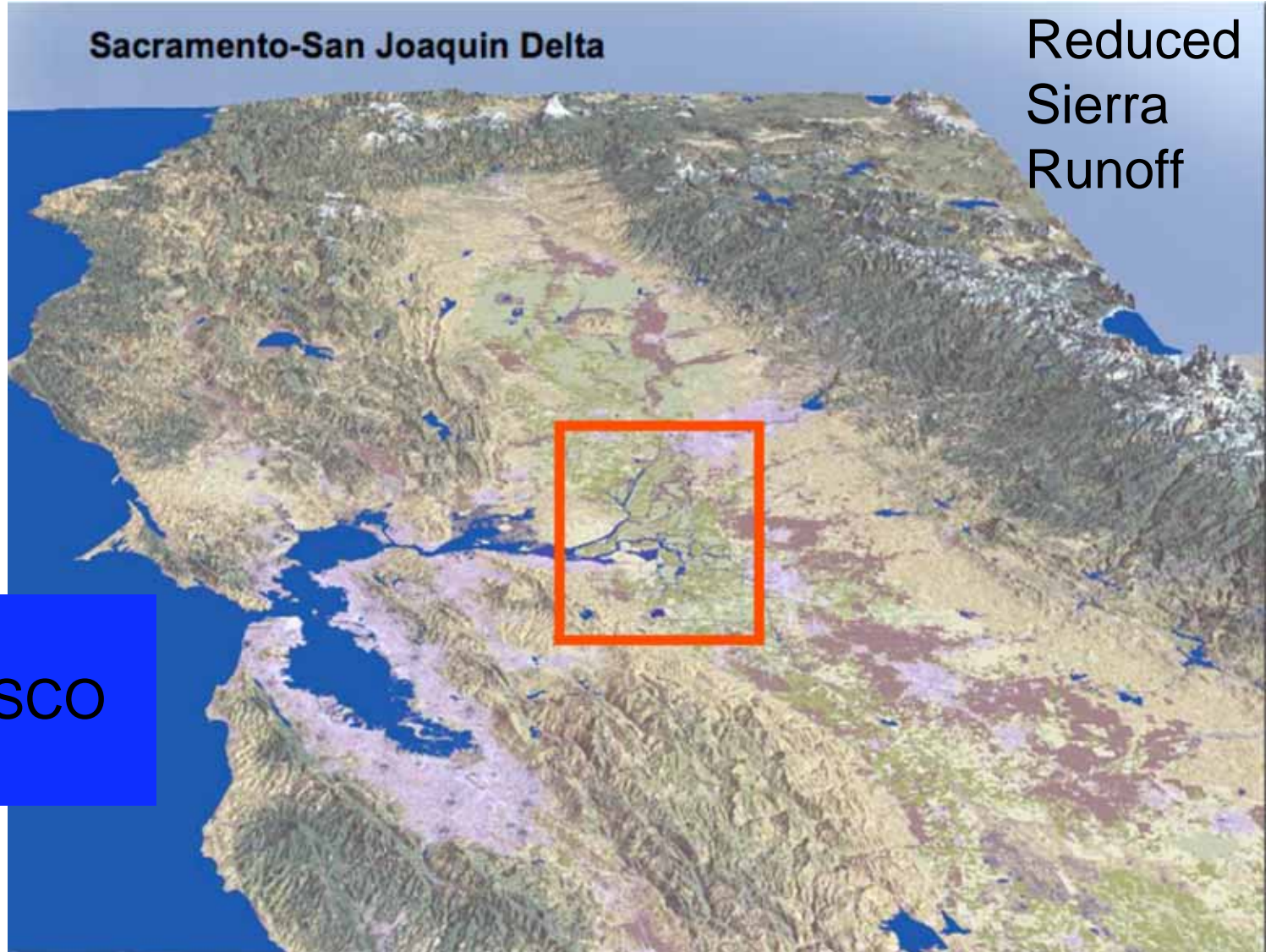


Sea-level
Rise

SAN
FRANCISCO
BAY

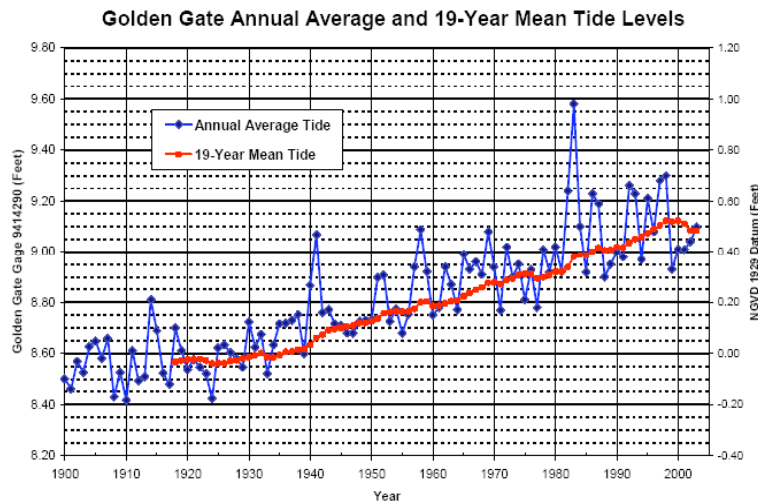
Sacramento-San Joaquin Delta

Reduced
Sierra
Runoff

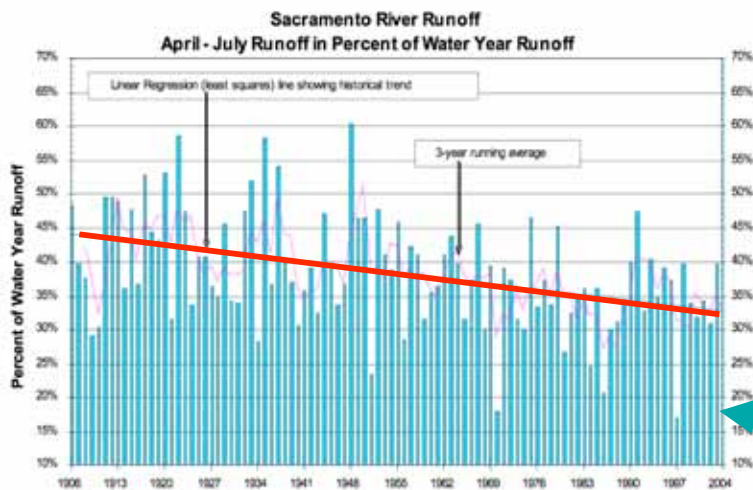


Water Quality

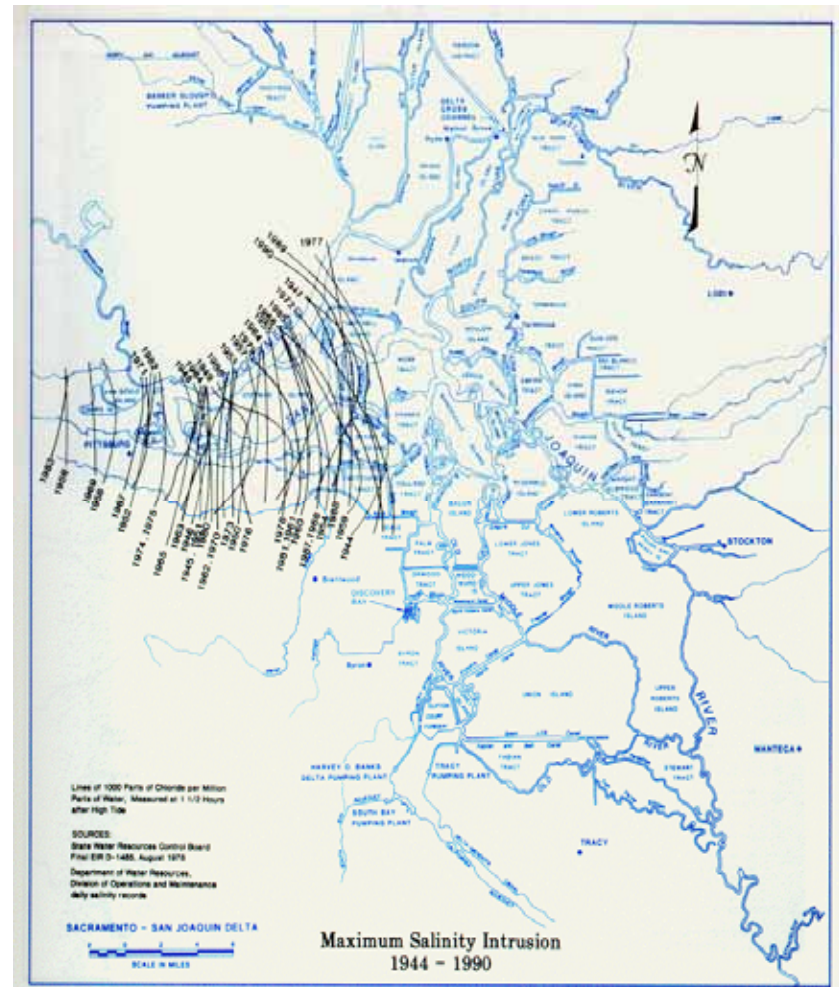
Sea-level Rise



Reduced Runoff



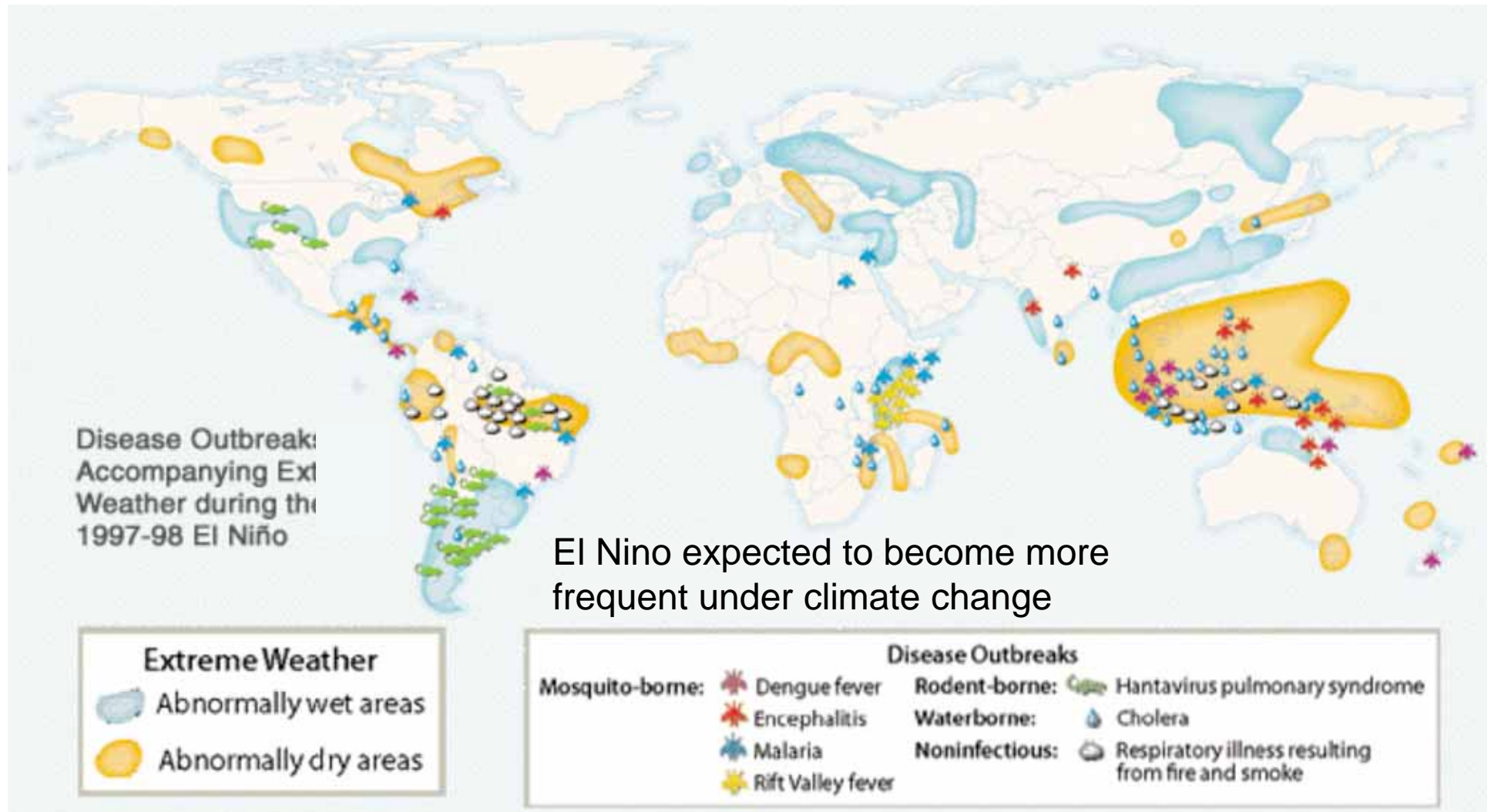
Salt Water Intrusion



For Caribbean: See paper from Mark Jury, UPRM

<http://baydeltaoffice.water.ca.gov/climatechange.cfm>

Correlation of Disease Clusters with the 1997-1998 El Niño



Source: Harvard Medical School, Center for Health and the Global Environment (*Science*)

Climate Change Liability: A Rapidly Emerging Issue

New IPCC Report has reduced the uncertainties

Business Insurance
February 5, 2007 www.businessinsurance.com

ANOTHER APPEALS COURT RULES CASH BALANCE PLANS DON'T DISCRIMINATE / PAGE 3 **FINANCIAL GUARANTEE INSURER PAYS \$75 MILLION TO SETTLE FINITE CHARGES / PAGE 3** **RADIO STATION RISK MANAGERS TO INCREASE ON-AIR OVERSIGHT AFTER CONTEST TRAGEDY / PAGE 3**

In Brief

Mich. court rejects same-sex benefits

Michigan's 2004 marriage amendment prohibits public employers in the state from offering health benefits to employees' same-sex domestic partners. The Michigan Court of Appeals says, by a 4-3 vote, that it is unconstitutional. See *Anderson v. Board of Directors, Township of Livonia*, and *City of Livonia v. Three Road Council*. Both public employers argue that respective domestic partnership agreements for the purpose of providing benefits "is not really about the percentage of the employment."

U.S. claims up in 2006: EFCC

A total of 75,768 discrimination charges were filed with the U.S. Equal Employment Opportunity Commission last year. See *EEOC*.

See IN BRIEF page 22

U.N. climate report stirs liability fears

Scientific testimony may fuel lawsuits on global warming

By ROBERTO CENICEROS

The publication of a U.N. report last week linking human activity to global warming could be enough to cause immediate liability problems for insurance companies, but it does increase the chances of more claims flowing through to insurance policies in the future, some experts say.

The report, which links the burning of fossil fuels with more extreme climate conditions, may increase the likelihood that commercial policyholders and their liability insurers will have to fund more defenses against claims.

When 14 nations last year "warned" that global warming played a role in causing Hurricane Katrina, which damaged the homeowners' properties.

The lawsuit, which lawyers say brought \$6.1 billion in damages, was dismissed. However, a federal judge in Louisiana, which dismissed the homeowners' properties.

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Marsh reaps \$3.9B with Putnam deal

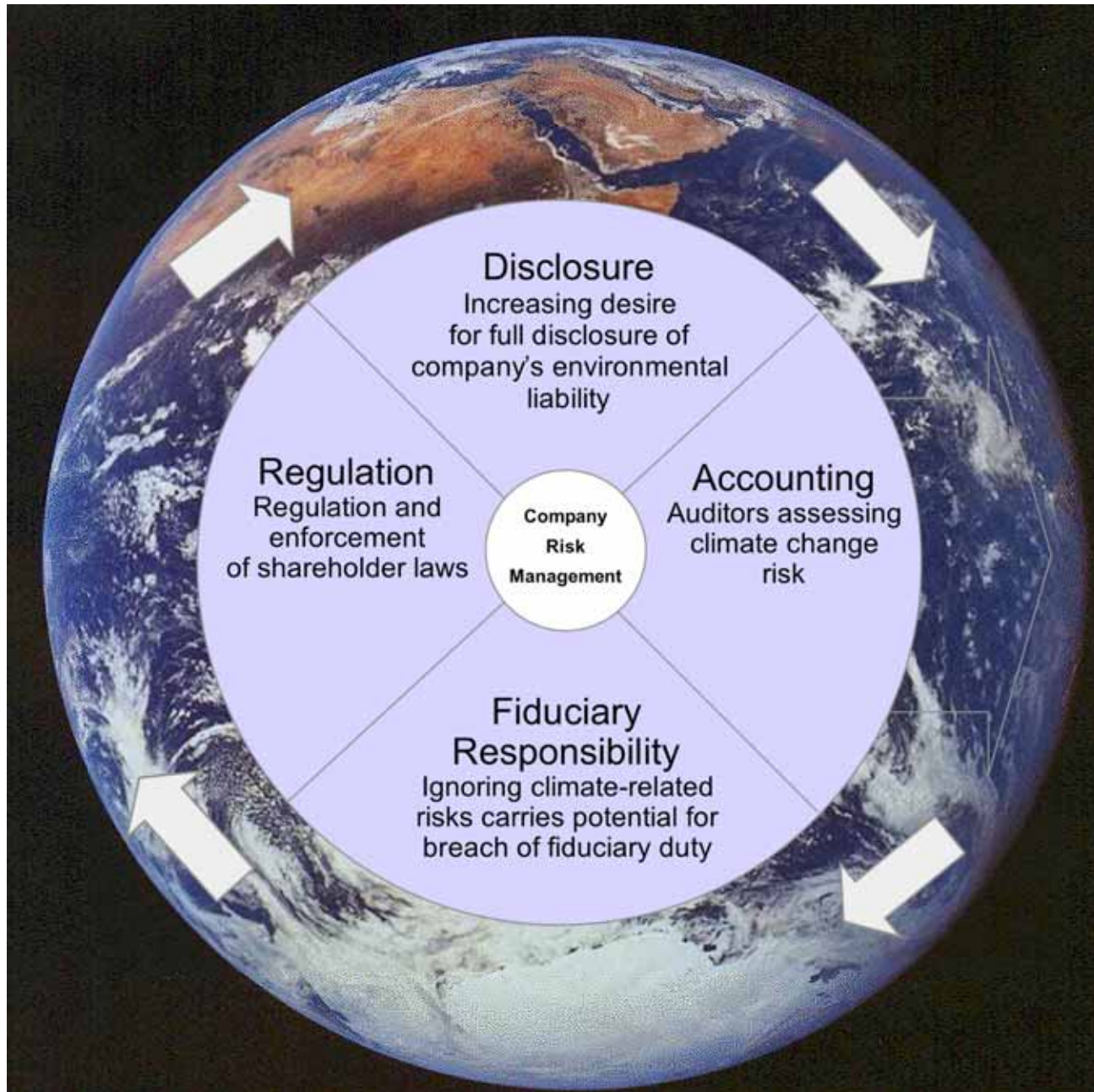
Investment firm sale will sharpen focus, boosts war chest

By SALLY ROBERTS

NEW YORK—Marsh Inc. announced last week that its sale to Putnam Investments, its investment management unit, will be completed by the end of 2007. The sale will make the company a major player in the financial industry.

Marsh, a 150-year-old insurance company, will be sold to Putnam, a 100-year-old investment firm, for \$3.9 billion. The sale will make the company a major player in the financial industry.

The Changing (Business) Climate



Business Value

- Negative impacts on company value, reputation & brand caused by ignoring climate change

Shareholder Demand for Action

Shifting Regulatory Environment

- Energy prices
- Carbon caps, etc.
- Compliance cost of "penstroke regulation"

Note: non-business entities also have liability insurance, e.g., local governments

Availability & Affordability

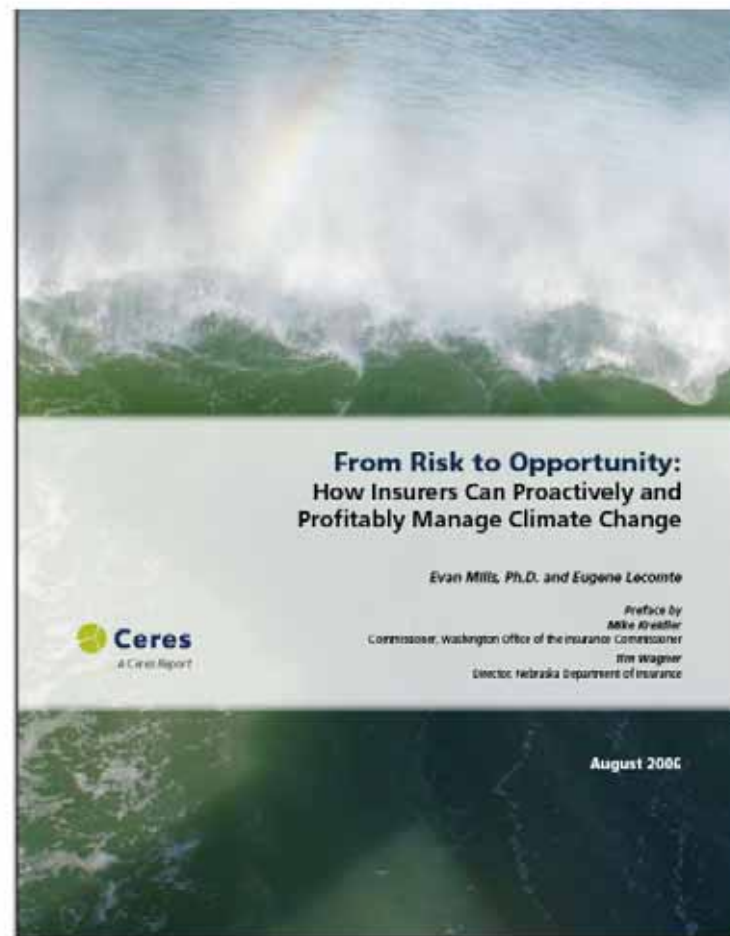
- Exodus from coastal areas
 - 600,000 cancellations/non-renewals, and counting
- Dramatic price increases
- “Hollowing out” of coverage
 - deductibles; exclusions
 - limits (aggregate versus per-event)
- Mandated “Residual Markets” growing rapidly
 - ~3 million policyholders in US
- Example of Pharmaceuticals:
 - (a) total capacity of \$1.3B reduced to 0.5B; (b) deductibles once \$25-\$35 million have ballooned to \$400 million, (c) premiums have tripled or quadrupled (d) more exclusions, (e) mutuals formed.

From Risk ... to Opportunity

The insurance sector has a key role to play in helping to mitigate the effects of climate change ... and by developing new products and solutions that can support emerging greenhouse-gas and renewable energy markets.

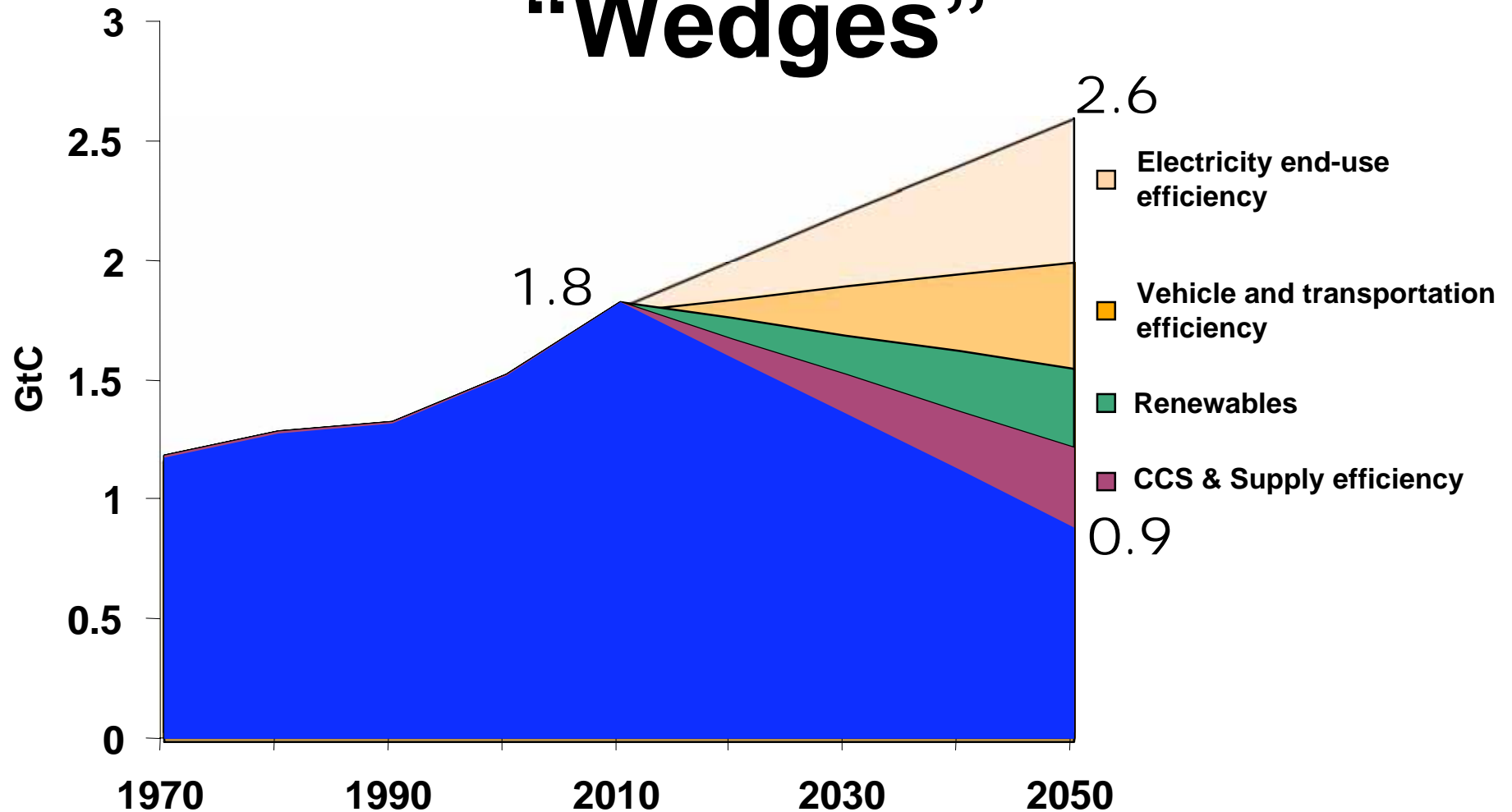
- Marsh & McLennan

Ceres Report: 25 strategies;
~220 examples; ~120 insurers



Cutting U.S. Emissions in Half with Climate-Stabalization

“Wedges”



After Pacala and Socolow (*Science*)

More Business!



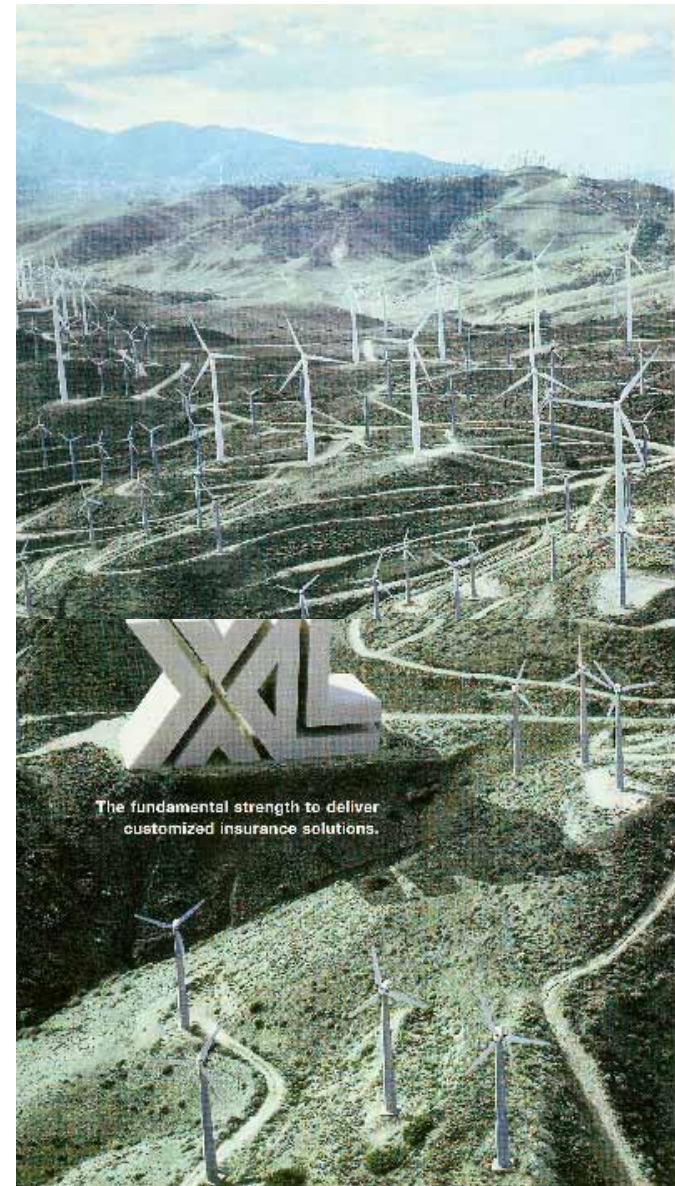
The strength, experience and flexibility to protect business against risk.

PROPERTY | CASUALTY | PROFESSIONAL | SPECIALTY

The XL Insurance Companies are one of the world's leading insurance providers, offering a wide range of products and services to meet your business needs. Our expertise in underwriting and claims management, combined with our global reach, allows us to deliver customized solutions for a wide range of risks.

XL Insurance Companies is a leading provider of property, casualty, professional and specialty insurance. Our global reach and expertise in underwriting and claims management, combined with our commitment to customer service, allows us to deliver customized solutions for a wide range of risks.

XL INSURANCE
FUNDAMENTAL STRENGTH - CAPITAL AND PEOPLE



The fundamental strength to deliver customized insurance solutions.

THE XL INSURANCE COMPANIES are chosen by the world's leading firms not only for the strength of our capital and the depth of our experience, but also for the quality and variety of our products.

PROPERTY
General All Risk Property Damage & Business Interruption | Energy & Construction All Risk | Fine Art | Ocean In Transit

CASUALTY
Primary Liability | Global Public & Products Liability | Automobile Liability | Health & Excess Liability

PROFESSIONAL
Directors & Officers | Employment Practices Liability | Errors & Omissions

SPECIALTY
Aviation & Space | Brokerage Liability | Liability | Marine & Marine Cargo | Programs

people, providing tailored solutions and services to meet your individual insurance requirements. If you expect more, visit www.xlinsurance.com or call us toll-free: 800-608-2510.

the XL Insurance Companies have a combined net worth of over \$100 billion. As of March 31, 2011, we have a combined net worth of over \$100 billion. As of March 31, 2011, we have a combined net worth of over \$100 billion.

XL INSURANCE
FUNDAMENTAL STRENGTH - CAPITAL AND PEOPLE

Promoting Loss Prevention

BASF Home - Patterson NJ

- Meets *Institute for Business and Home Safety's* “Fortified... for safer living” stds.
 - Wind-resistant rigid foam panel walls and multi-glazed windows
 - Ice-dam resistant
 - Mold resistant
 - Water-resistant insulation



Some insurers are giving premium credits....

Crafting Innovative Insurance Products

- ***Fireman's Fund***: first-ever “Green-Buildings Insurance”
 - Premium credits for green features
 - Rebuild green after loss
- ***Lloyds***: Energy Savings Insurance; ***Munich Re***: geothermal performance insurance
- ***Munich Re***: Climate insurance Initiative (MCII) for developing countries



Providing New Customer Services

- **Insurance Australia Group** offering on-line automobile carbon-offset service for customers

Calculate your CO₂

Offset your emissions

Take our survey


Play the game

Climate Help

- Climate change
- Going carbon neutral
- What we're doing
- How you can help

FAQ

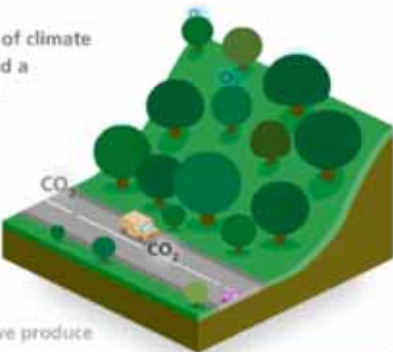
Contact



Don't underestimate the effects of climate change.


With recent events like Hurricane Katrina, persistent droughts, and worsening bushfire seasons, there are now more signs than ever that our climate is changing.

Because cars are a significant cause of climate change, NRMA Insurance has created a new environmental program called Climate Help. It shows you how to offset your car's emissions, and how to help combat climate change with a unique method called carbon credits.



Forests reduce the CO₂ we produce.

Next >



Climate Help

Pay for your emissions

Back to Climate Help

Paying for your emissions is one of the simplest things you can do to help the environment. And we've tried to make it even simpler by allowing you to pay online with your credit card.

It's good to know you're doing the right thing, so we can also send you a certificate confirming that your car emissions will be offset. Just check the box on the next page and we'll email it to you in PDF format.

Calculate your CO₂

Choose your car type (Small, Hatch)

Small

How far do you drive each year? (Hatch, Hatch)

Between 10,000 kms and 15,000 kms per year

Your car emits 2.1 tonnes of CO₂ emissions annually

To offset your emissions for 12 months you need to pay \$32.93*

*It costs \$15.66 to offset one tonne of CO₂

Pay for your emissions

Title: First name Surname

Mr. [] []

Email: [] Age: 18-24 years

Are you an NRMA Insurance customer? Are you an IAG staff member?

Yes No Yes No

Name on credit card: [] Credit card number: [] Expiry Date: 01 / 06 Credit Card Type: []

We do not accept AMEX or Direct Club

You are paying \$32.93

Next >

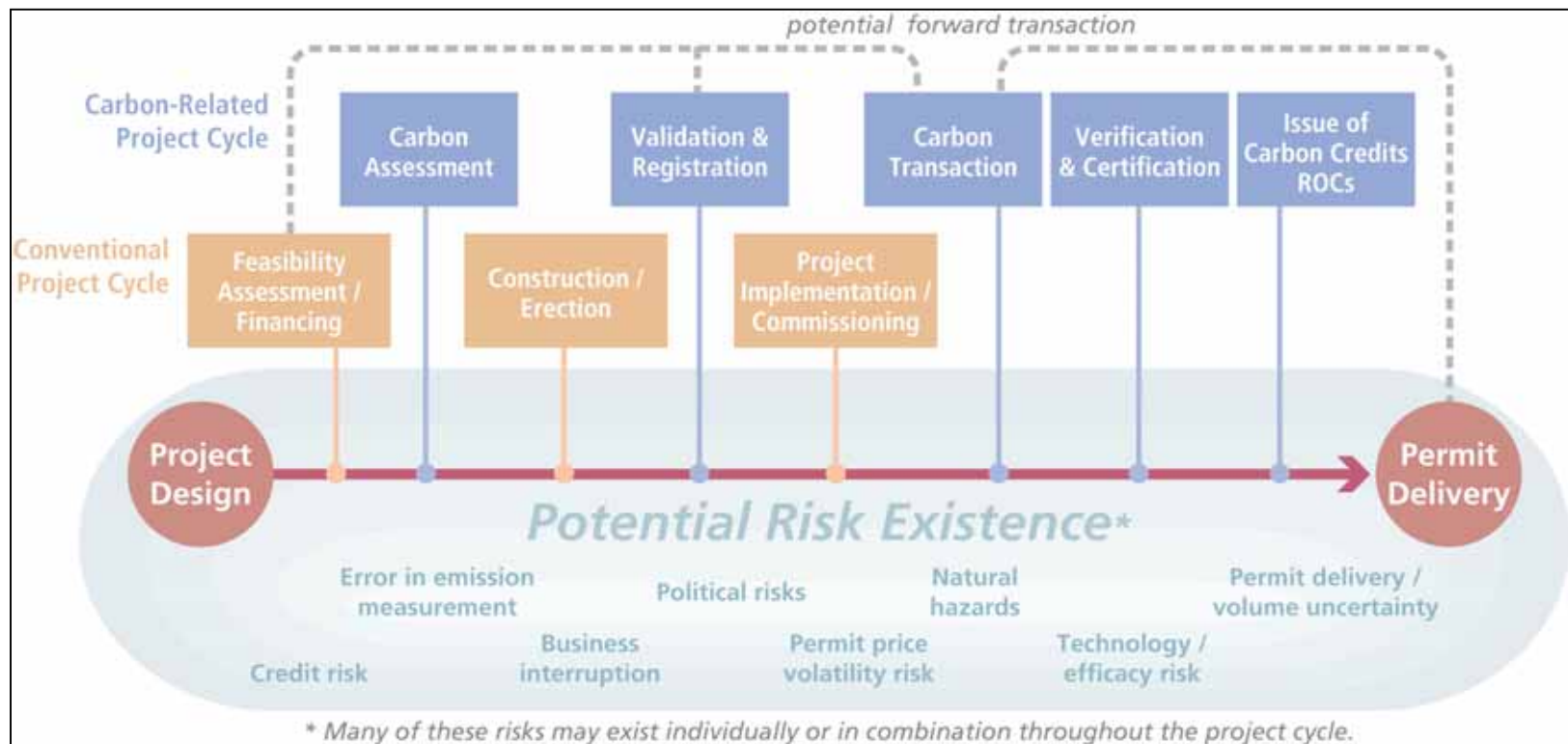
© 2006 Insurance Australia Limited ABN 11 000 010 722 AFS Licence No. 227681 trading as NRMA Insurance An IAG Company.

By accessing and using this website you agree to the [Terms of Use](#) including the disclaimer.

Source: <http://www.climatehelp.com.au/>

Participating in Carbon Markets


- *AIG, Marsh*, others offering carbon project risk-management consulting services; insurance



Source: Marsh. 2004. "Responding to Climate Change Risks and Opportunities."

Rewarding Customers' Good Behavior

- **Travelers** offers 10% premium discount to drivers of hybrids
- **GMAC** offers “pay-as-you-drive” insurance discounts of up to 40%



**Goes beyond fossil fuels.
And fossil insurance policies.**

It's just what the insurance world needs—more blue sky thinking. At Travelers, we're always working to identify changes in the world and to make sure your policies stay in-synch. From the discount we offer forward-thinking hybrid drivers to our monitoring of new risks, we help insurance keep up with life—whatever the road ahead may bring. Call an independent agent. After all, your world is always evolving. So should your insurance.

travelers.com

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TRAVELERS
Insurance. In-synch.™

Financing Solutions

- *Tokio Marine & Nichido* has reforested 7,500 acres of mangroves in Indonesia, Thailand, Philippines, Myanmar and Vietnam. 5,000 more acres in progress



Source: <http://www.tokiomarine-nichido.co.jp/english/index.html>

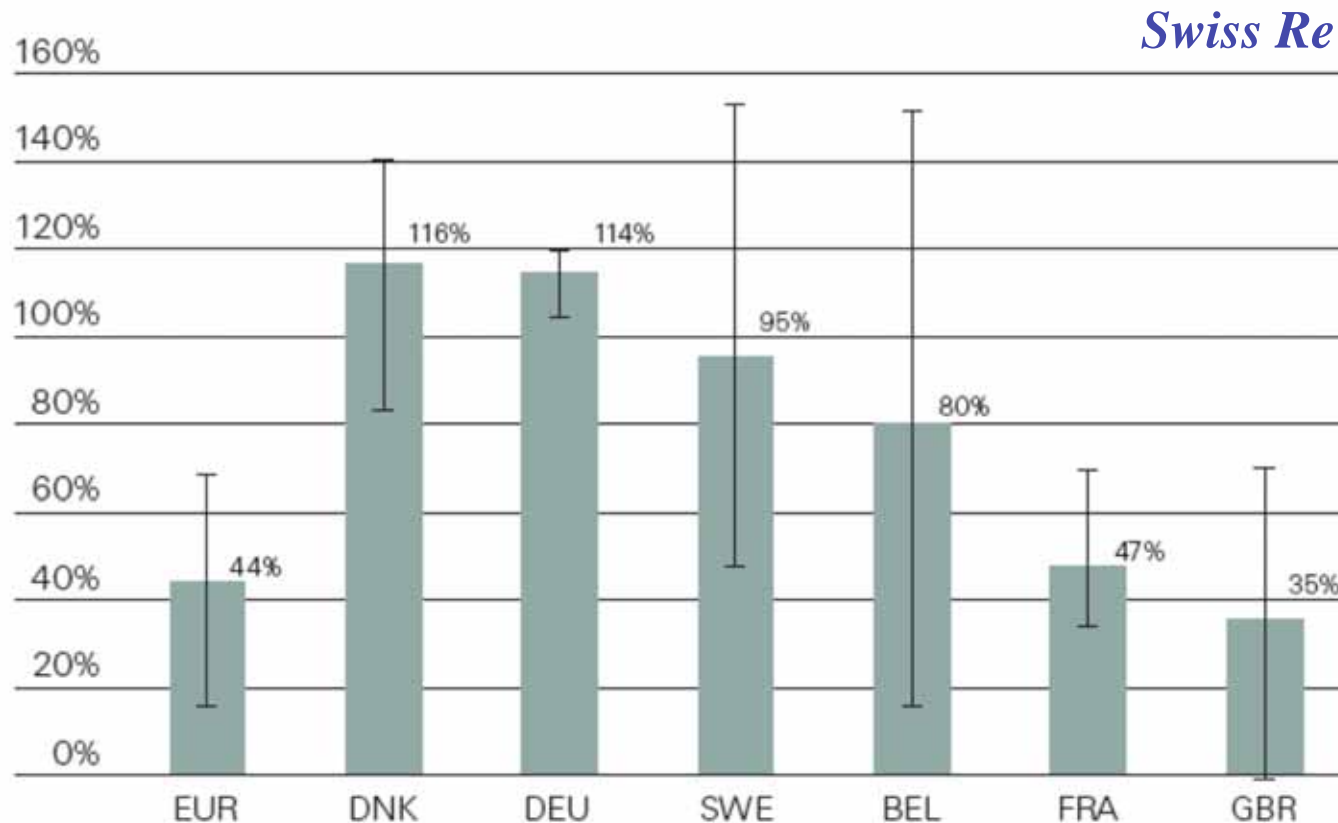
Sustainable Asset Management

- **Munich Re:** membership in sustainable investment indices; screens its own investments
- **Allianz:** endorsed the Ceres/INCR "Call to Action"
- **Gerling:** Select 21 Fund includes energy and environmental criteria in the selection of securities.



Conducting Research

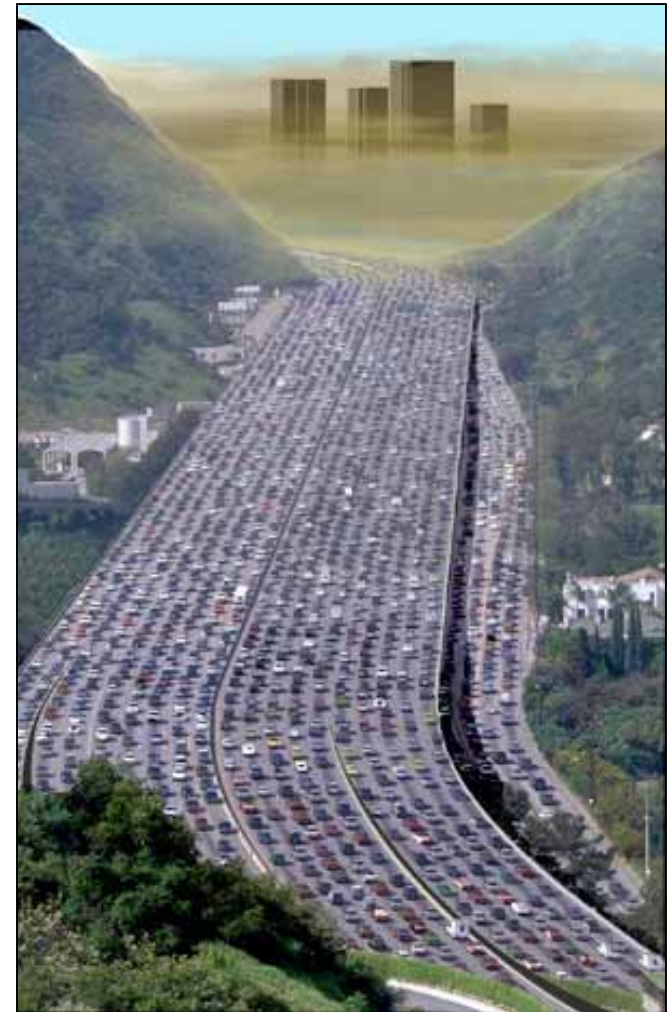
Expected increase in annual windstorm loss in Europe



Increase in annual expected loss for Europe (EUR), Denmark (DNK), Germany (DEU), Sweden (SWE), Belgium (BEL), France (FRA) and the UK (GBR) over the period 1975 to 2085 (in %). The broad bars represent the mean value of the climatic models, and the error bars show the spread of the results from all models

Participating in Public Policy Discussions

- ***American Insurance Association*** - Endorsing public transportation; reduced speed limits; telecommuting based on win-win benefits
- ***Association of British Insurers*** advising City of London on land-use planning and flood defenses



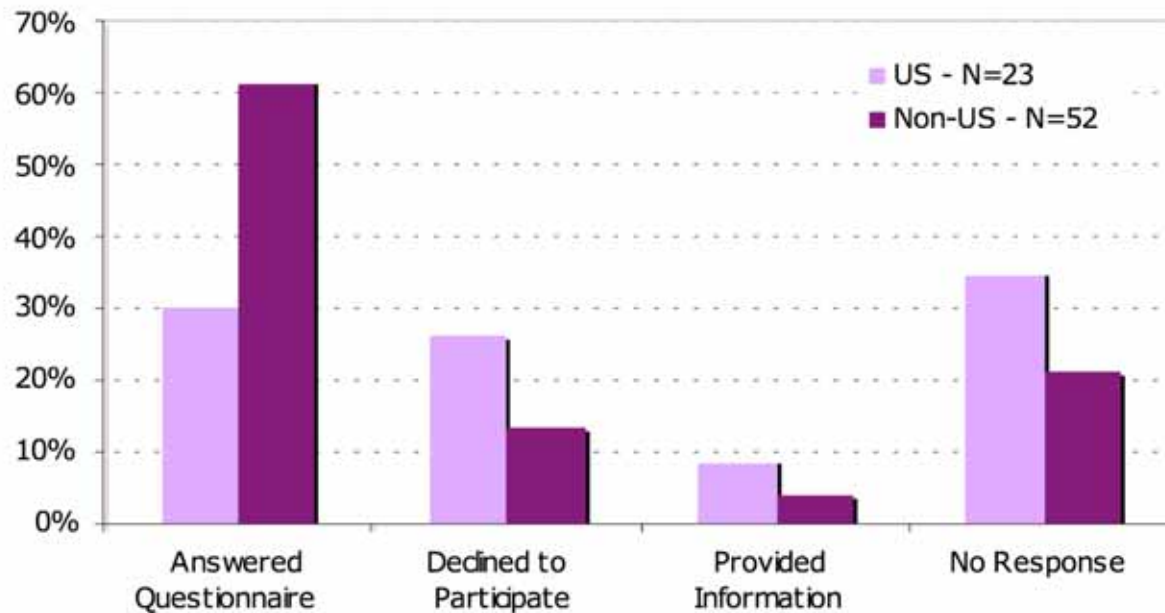
Leading by Example

Carbon Disclosure Project
Insurers' responses: *AIG, Aon, Marsh & McLennan, MBIA, Safeco, St. Paul Travelers, Unum Provident*



Swiss Re's
“Gherkin”
building (London)

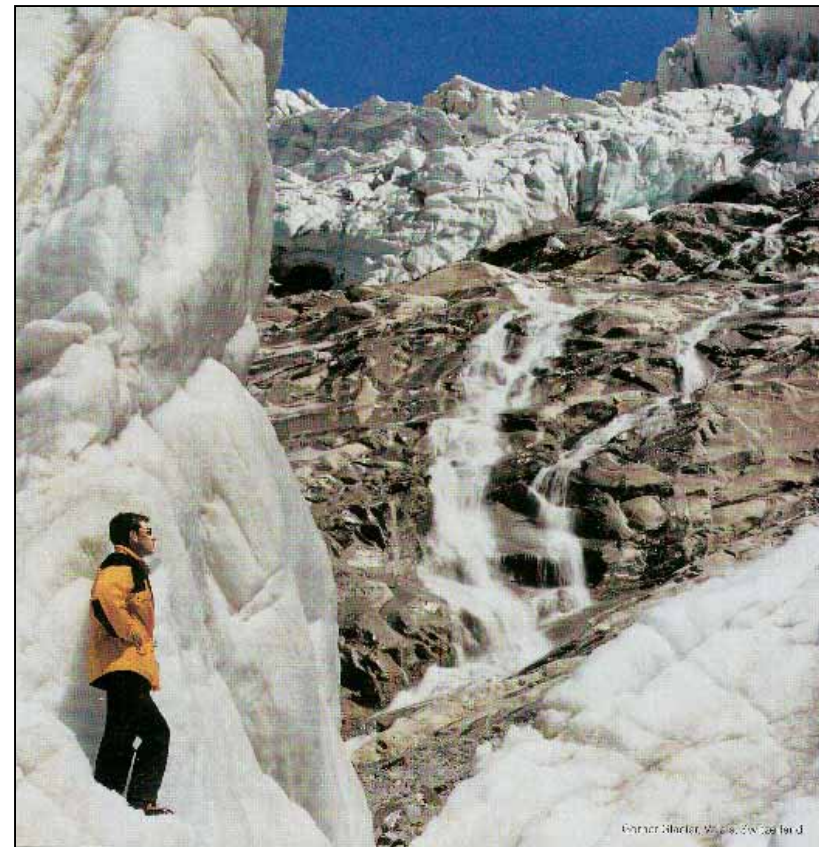
- Energy efficiency
- Daylighting
- Natural ventilation



Source: <http://www.cdproject.net/>

Educating Fellow Insurers

- **Swiss Re** has run *regular* full-page adds on climate change in major insurance trade journals for several years




© 2011 Swiss Re Ltd.

Ivo Menzinger, Sustainability Expert, Swiss Re

"Today, climate change is a fact. And change presents us with both risks and opportunities. Ivo Menzinger and his team identify environmental risks and help develop sustainable strategies to cope with them. Swiss Re was among the first to recognize the potential impact of climate change on the financial services industry and to study all active ways of managing associated risks. Combining expertise and financial strength, Swiss Re is ideally positioned to provide your company with tailored solutions to mitigate your exposure and protect your business against uncertainty. In a climate of uncertainty, that's your best option. www.swissre.com

Expertise you can build on. **Swiss Re**



Risks are also associated with responses to climate change



- **Emissions reduction** –
 - supply- and demand-side energy choices
 - Green Buildings
 - Nuclear power
 - Hydrogen energy
 - Renewable energy
 - Carbon capture & storage

Carbon Capture and Storage (CCS)

- Lake Nyos - 1986
(Cameroon): Natural CO₂ leak suffocated 1800 people, 3500 farm animals



Bottom Lines....

- The insurance sector - *a powerhouse*
- Risks from climate change - *material*
- Risks from responses - *under-appreciated*
- Opportunities - *very significant; off to good start*
- Emission vs. impact reduction: *strong synergisms*

<http://insurance.lbl.gov>

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